In[723]:=
```
SetOptions[Plot, ImageSize → 800];
SetOptions[AudioPlot, ImageSize → 800];
SetOptions[ListLinePlot, ImageSize → 800];
SetOptions[ArrayPlot, ImageSize → 800];
SetOptions[MatrixPlot, ImageSize → 800];
SetOptions[Spectrogram, ImageSize → 800];
SetOptions[Histogram, ImageSize → 800];
SetOptions[ListDensityPlot, ImageSize → 800];
```

In[731]:=
```
filePath =
  "/Volumes/External 1/uap/Videos/The_San_Diego_Sphere___Full_Resolution_12-
    Minute_Tape.mp4";
a = Audio[filePath];
a = AudioTrim[a, 5];
a = AudioChannelMix[a, "Mono"];
(*amplitude=AudioBlockMap[Max[.02,Sqrt@Mean[#^2]]&,a,{.01,.005}];*)
(*a = AudioNormalize[a/Audio[amplitude]];*)
ad = AudioData[a];
```

In[736]:=
```
AudioPlot[a]
```

Out[736]=

0.5
−0.5
0 1 2 3 4

In[737]:=
```
hfc = Rescale@AudioLocalMeasurements[a, "HighFrequencyContent"];
Quiet@AudioPlot[a, PlotRange → {All, All}, Appearance → "DiscreteAbs",
  ColorFunction → Function[{x, y}, ColorData["SunsetColors"]@hfc[x]]]
```

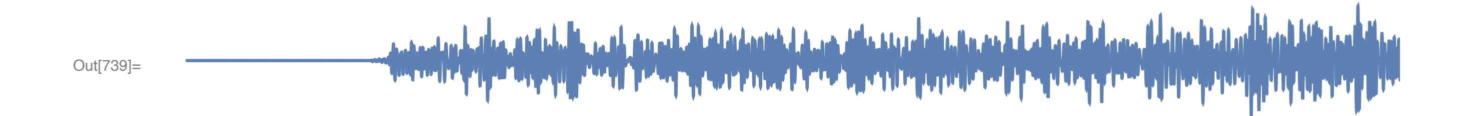
Out[738]=

0.15
0.05
0 1 2 3 4



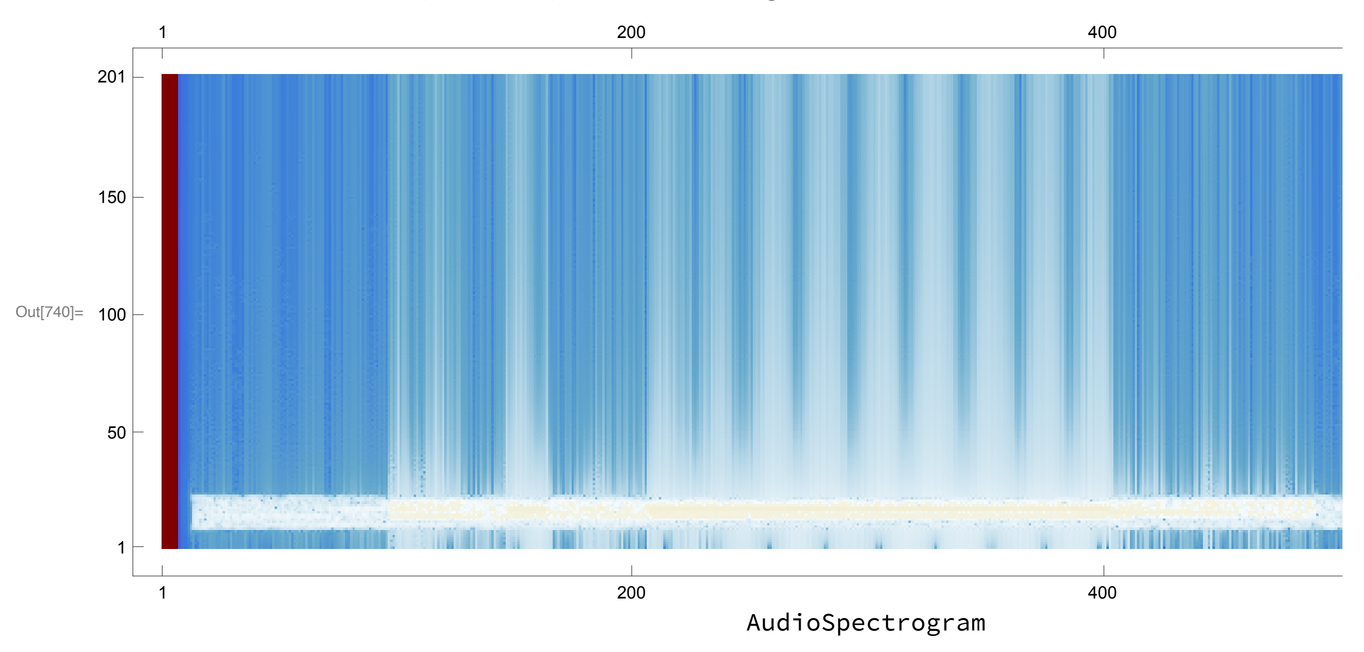
In[739]:=
```
ListLinePlot[Plus @@ ad⟦All,  ;; 44 100⟧, PlotRange → All, Axes → False]
```

Out[739]=



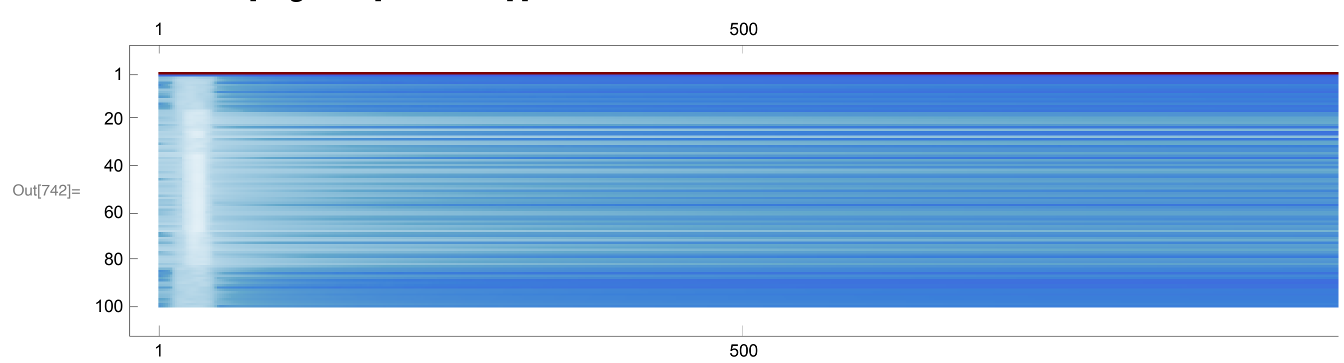
```
In[740]:= Labeled[MatrixPlot[Log@Transpose@Normal[NetEncoder["AudioSpectrogram"][a]],
            DataReversed → {True, False}], "AudioSpectrogram"]
```

Out[740]=



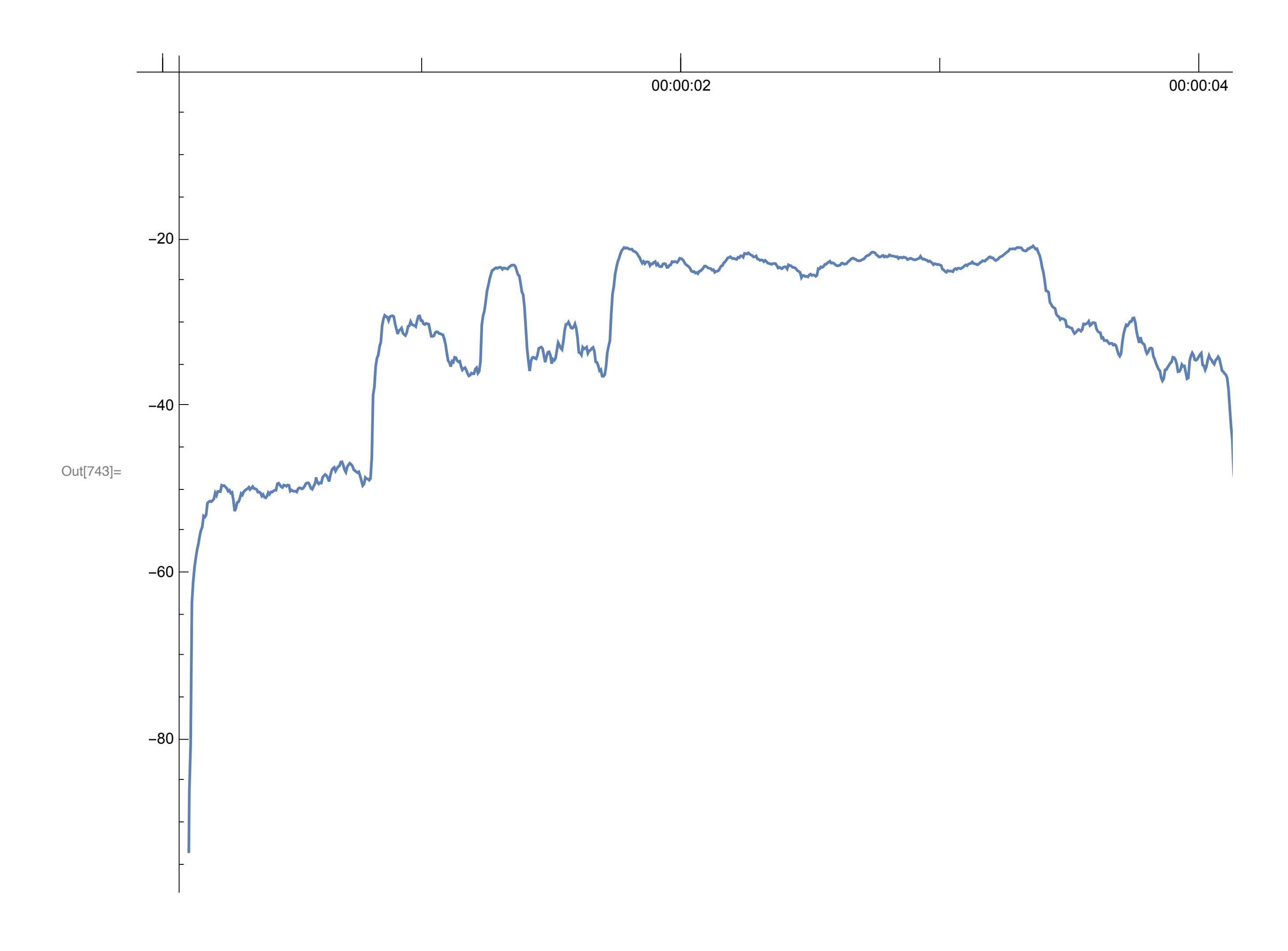

```
In[741]:= res = AudioBlockMap[LowpassFilter[#PowerSpectrum, .4] &, AudioNormalize@a, .05];
          MatrixPlot[Log@res["Values"]]
```

Out[742]=

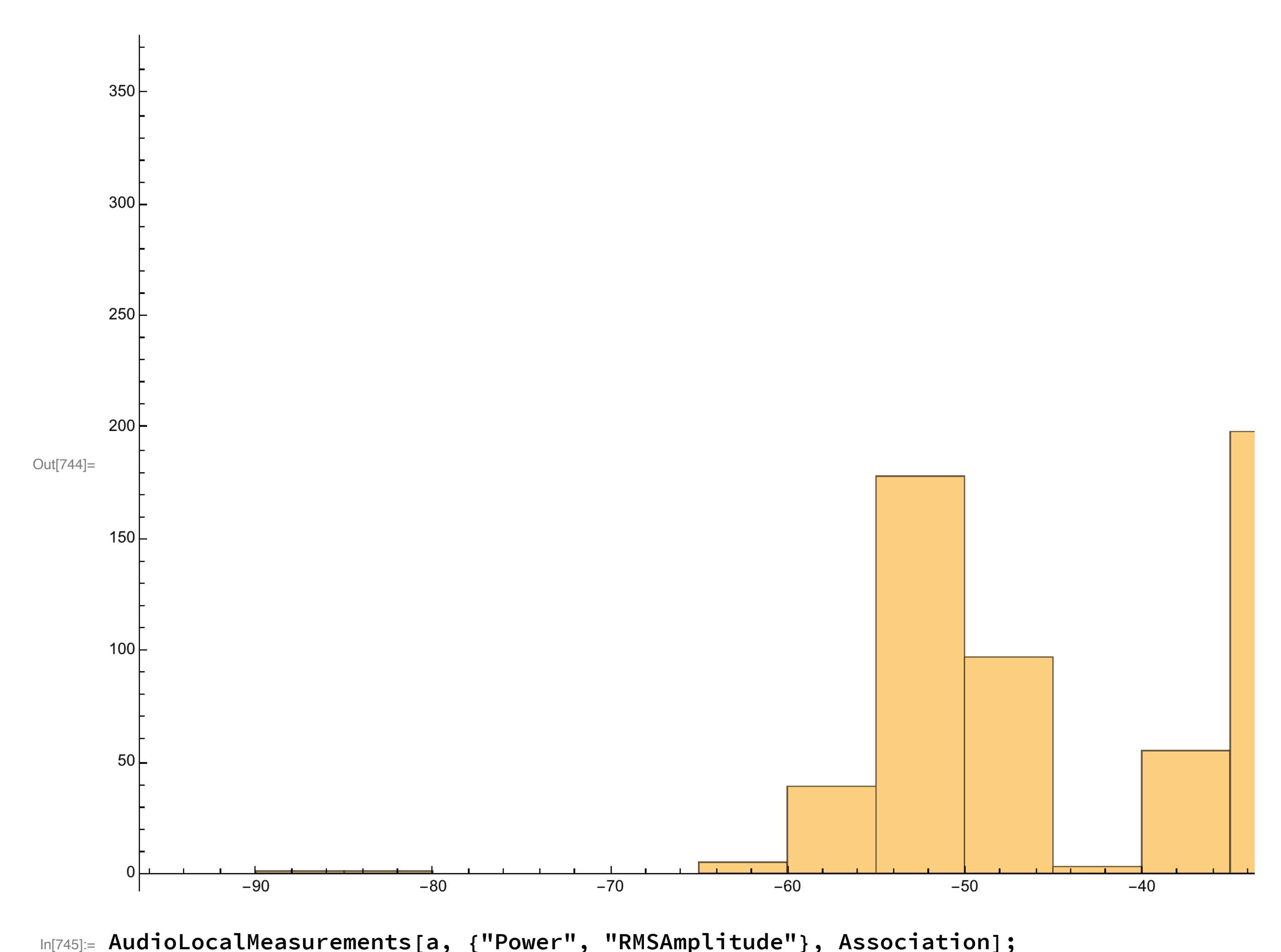



```
In[743]:= dBrms = AudioBlockMap[20 Log10[Sqrt@Mean[#^2]] &, a,
            {Quantity[50, "Milliseconds"], Quantity[5, "Milliseconds"]}];
          ListLinePlot[dBrms]
          Histogram[dBrms, 40]
```

Out[743]=



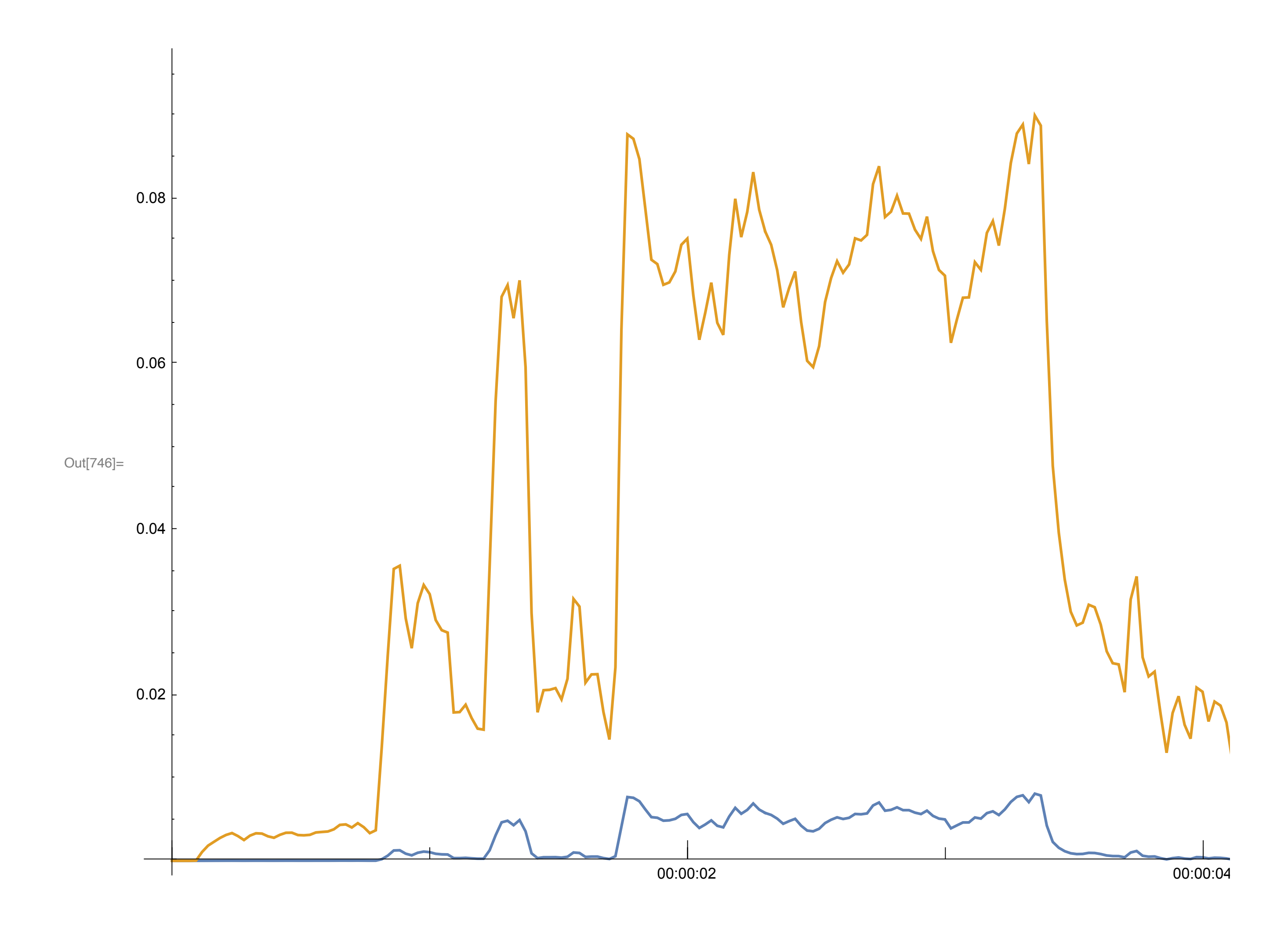
Out[744]=



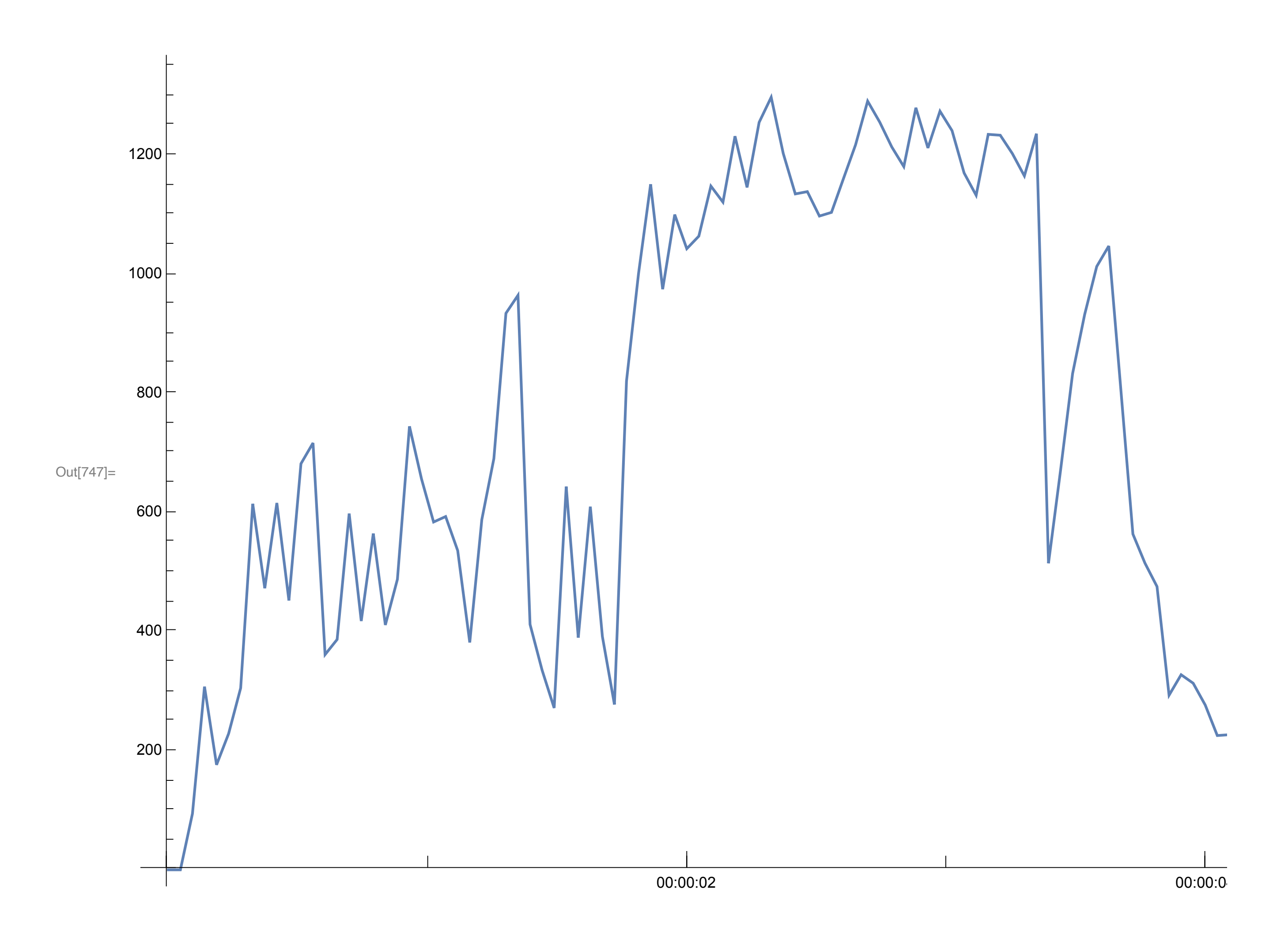
In[745]:=

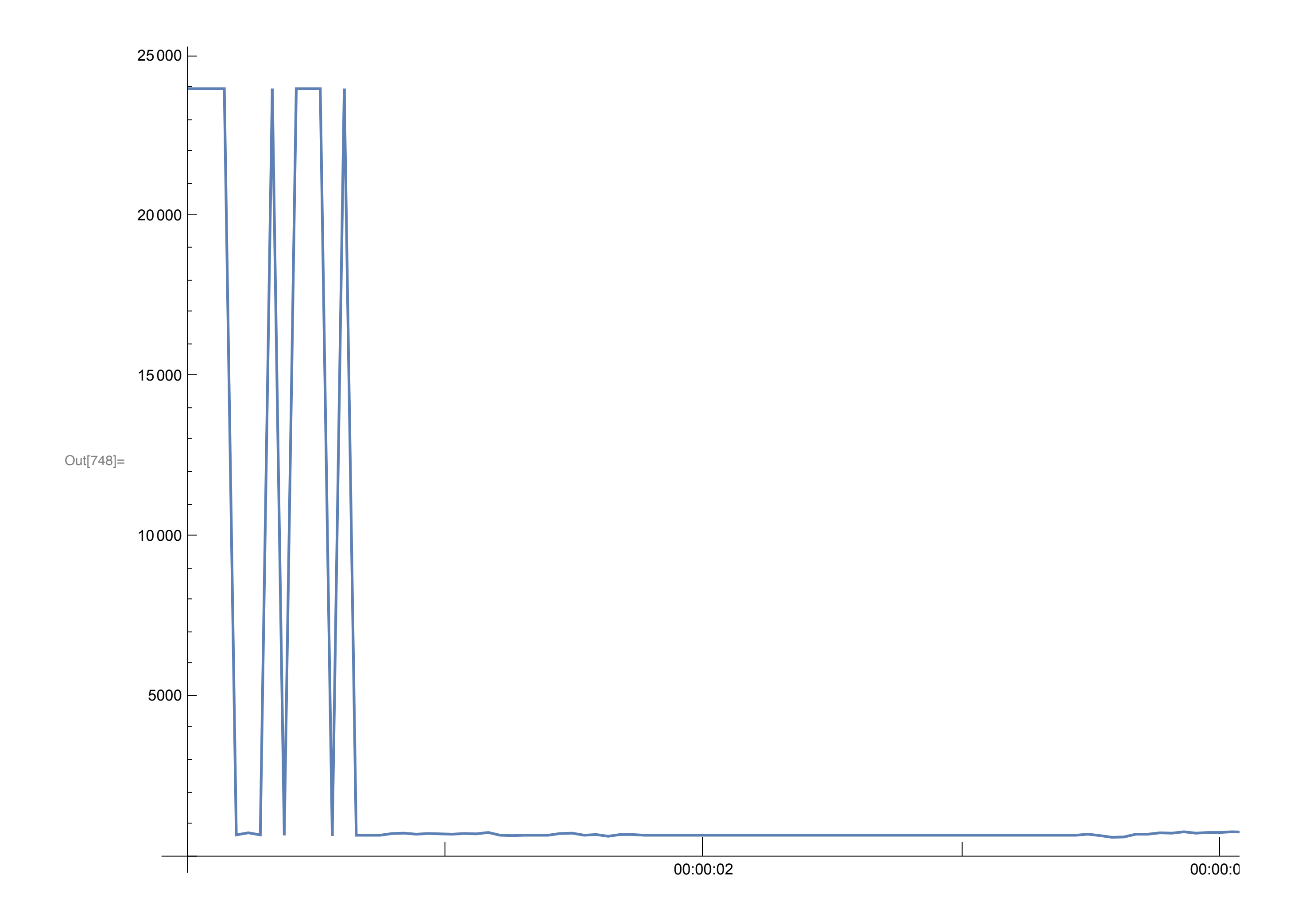
```
AudioLocalMeasurements[a, {"Power", "RMSAmplitude"}, Association];
ListLinePlot[%, PlotRange → All]
AudioLocalMeasurements[a, {"SpectralCrest"}] // ListLinePlot
AudioLocalMeasurements[a, {"SpectralRollOff"}] // ListLinePlot
AudioLocalMeasurements[a, {"SpectralSlope"}] // ListLinePlot
AudioLocalMeasurements[a, {"SpectralFlatness"}] // ListLinePlot
AudioLocalMeasurements[a,
   {"SpectralCentroid", "SpectralKurtosis", "SpectralSpread"}] //
  ListLinePlot[#, PlotRange → All] &
AudioLocalMeasurements[a, "FundamentalFrequency"] // ListLinePlot
AudioLocalMeasurements[a, "HighFrequencyContent"] //
  ListLinePlot[#, PlotRange → All] &
ListLinePlot[AudioLocalMeasurements[a, {"Mean", "Median", "StandardDeviation"}]]
ListLinePlot[AudioLocalMeasurements[a, {"Max", "MaxAbs", "Min", "MinAbs"}]]
ListLinePlot[AudioLocalMeasurements[a, "TemporalCentroid"], PlotRange → All]
ListLinePlot[AudioLocalMeasurements[a, "ZeroCrossingRate"], PlotRange → All]
```

Out[746]=

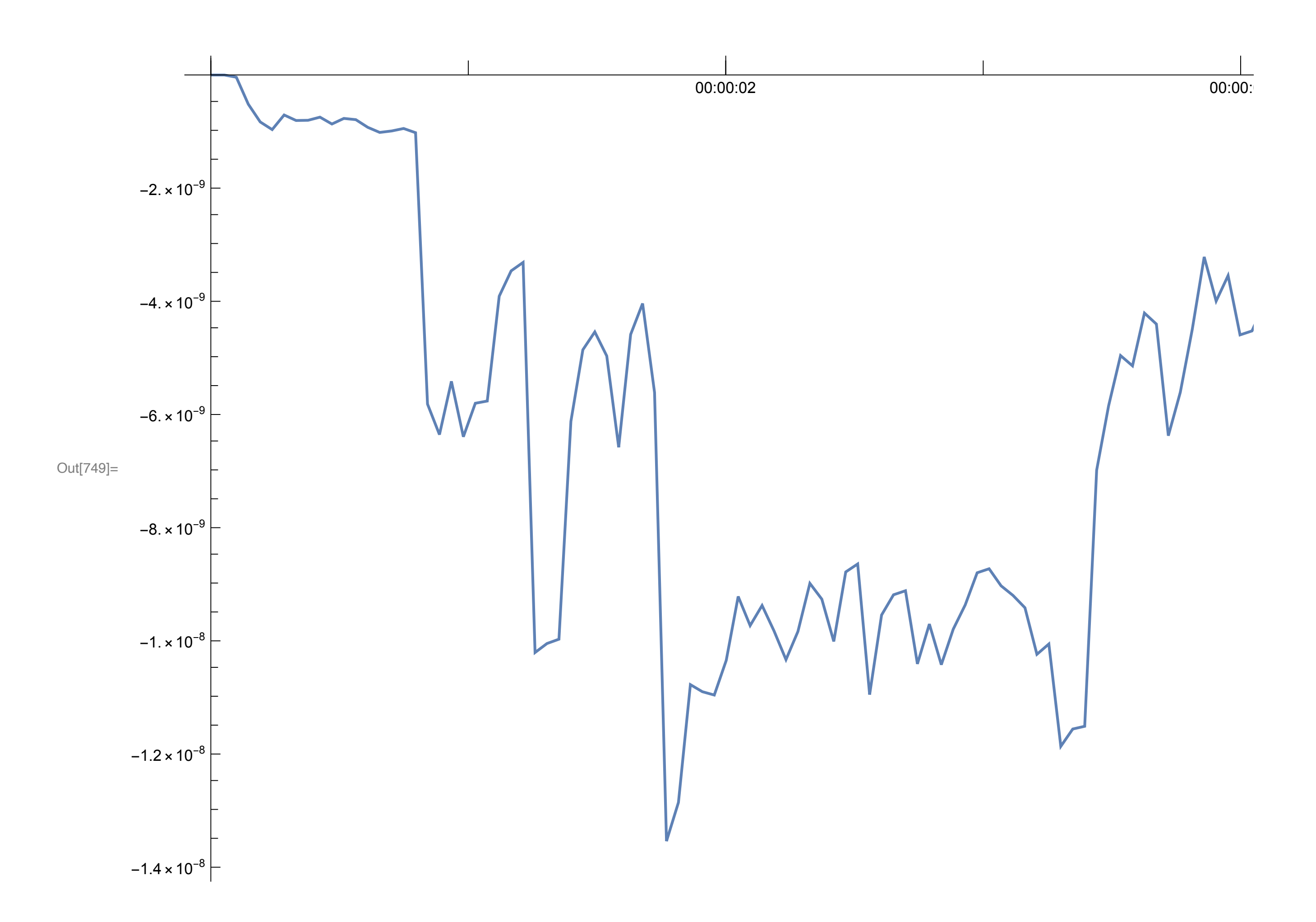


Out[747]=

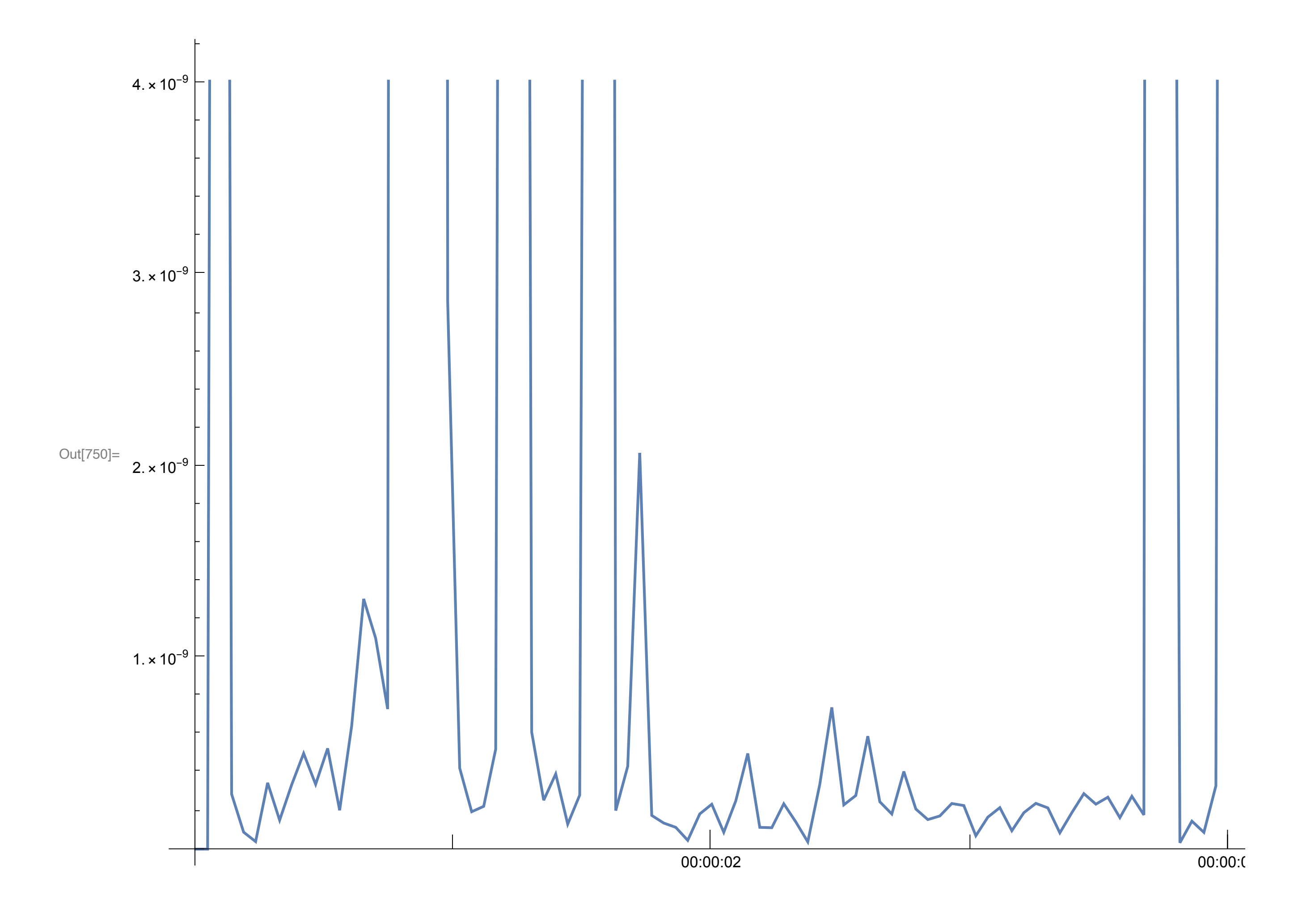



Out[748]=
25 000
20 000
15 000
10 000
5000
00:00:02
00:00:0

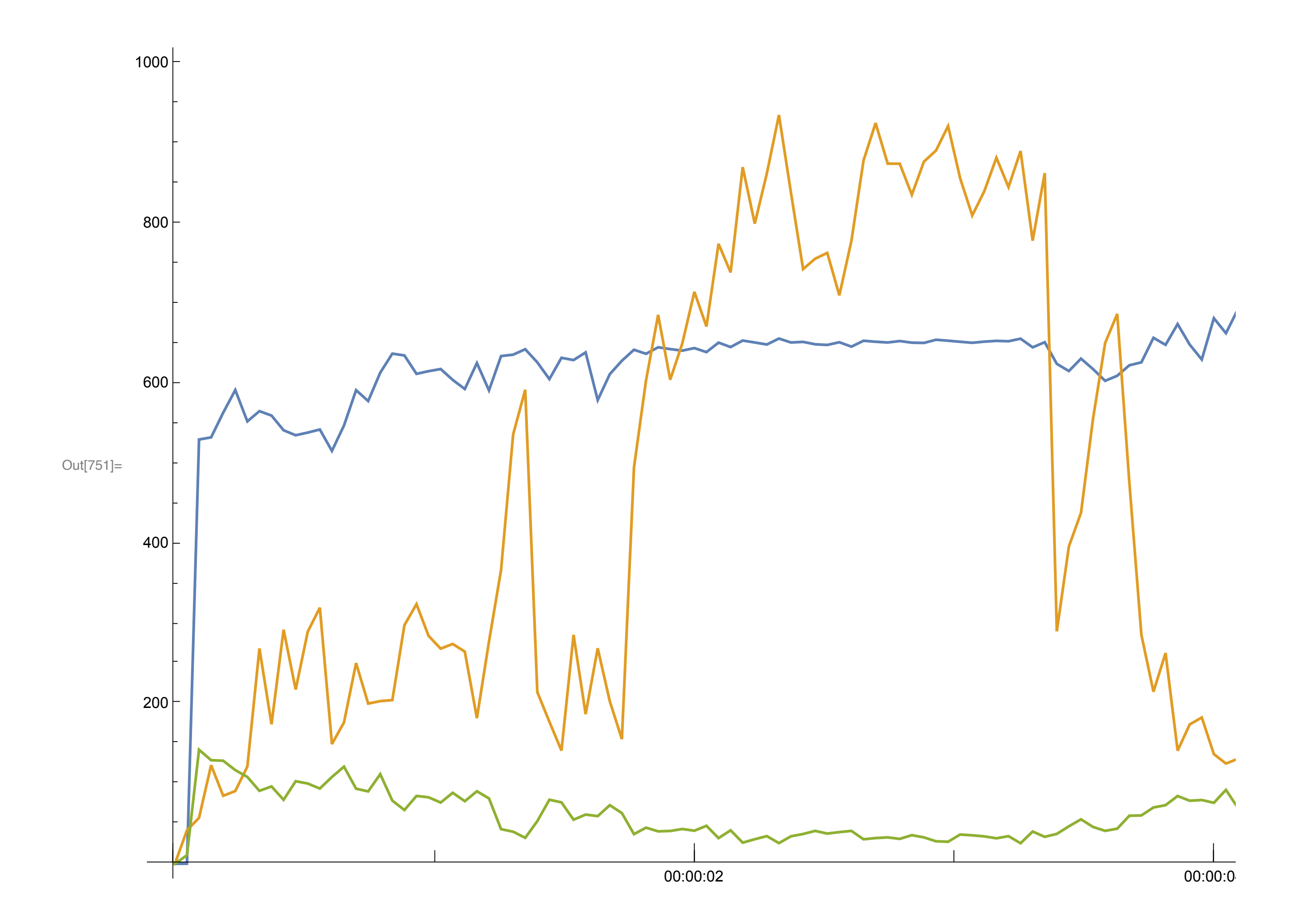
Out[749]=



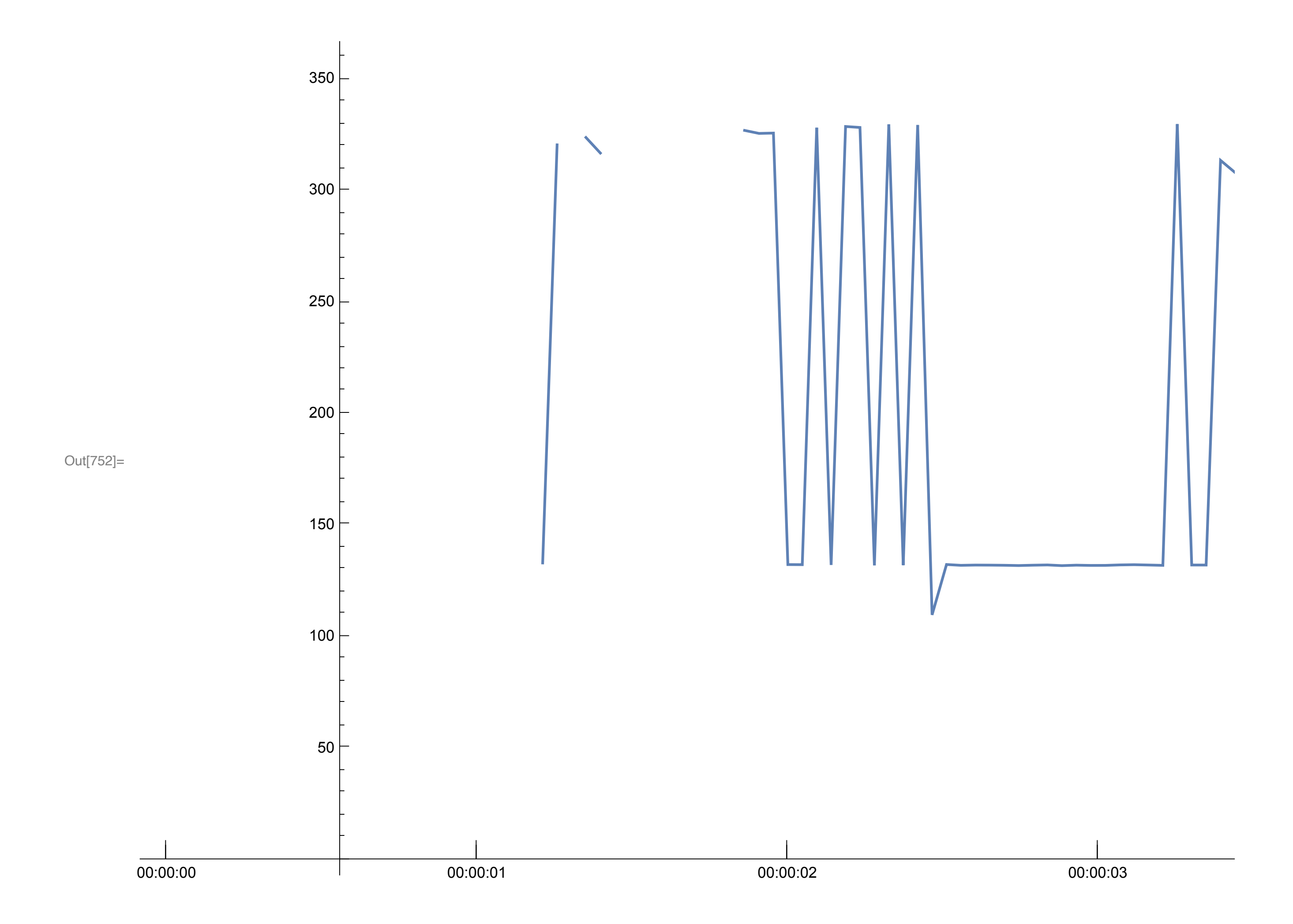
Out[750]=



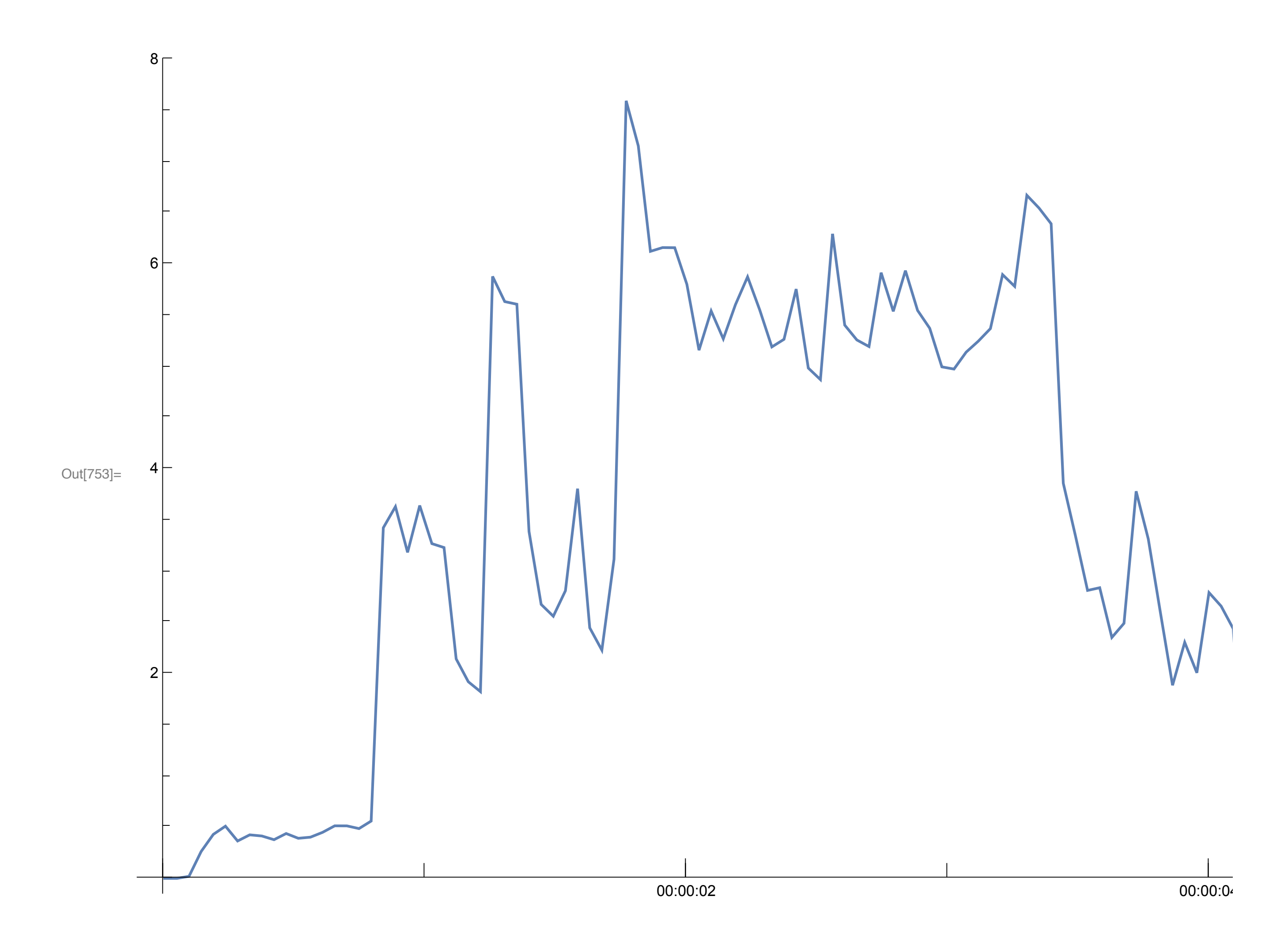
Out[751]=



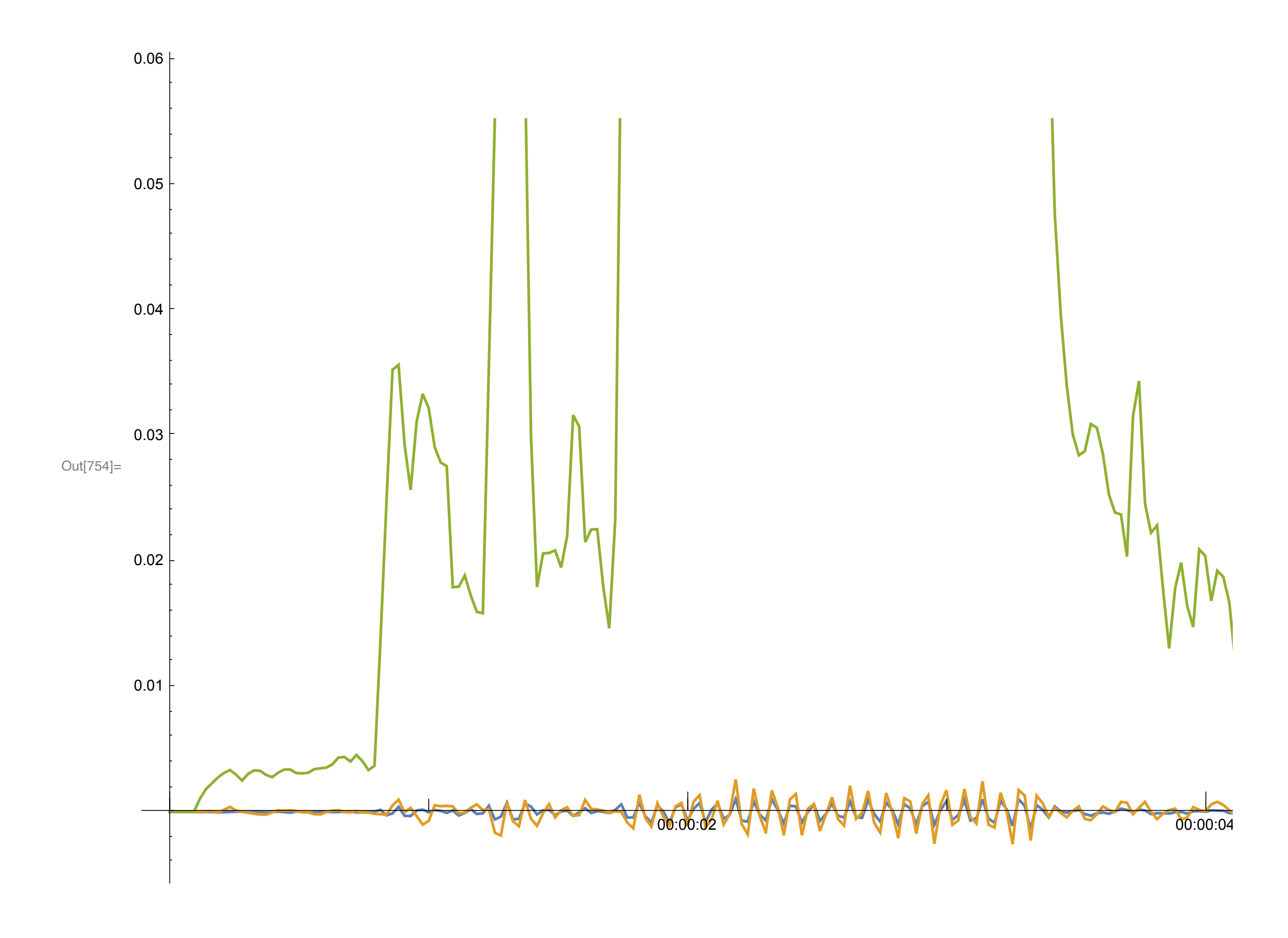
Out[752]=



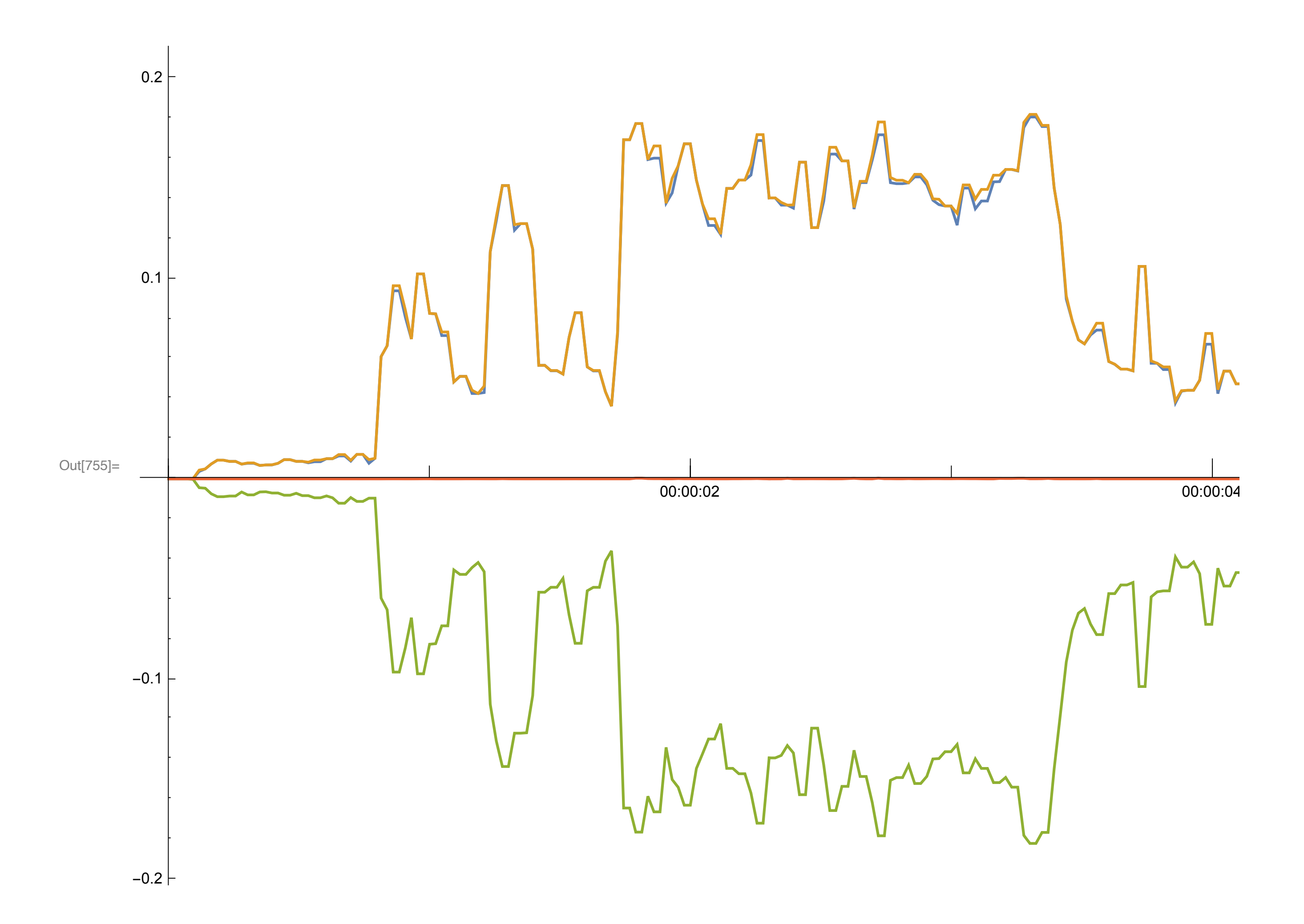
Out[753]=



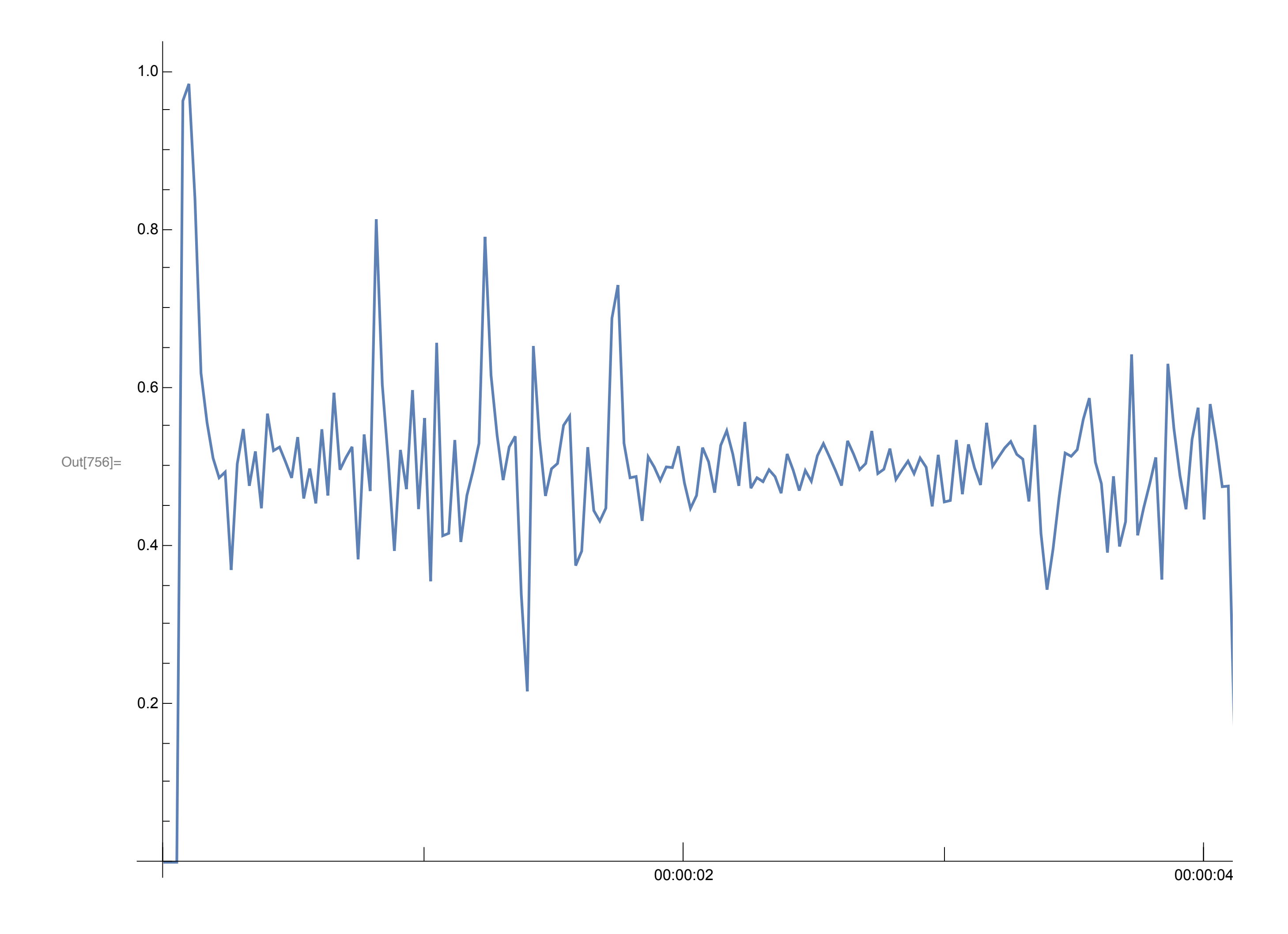
Out[754]=



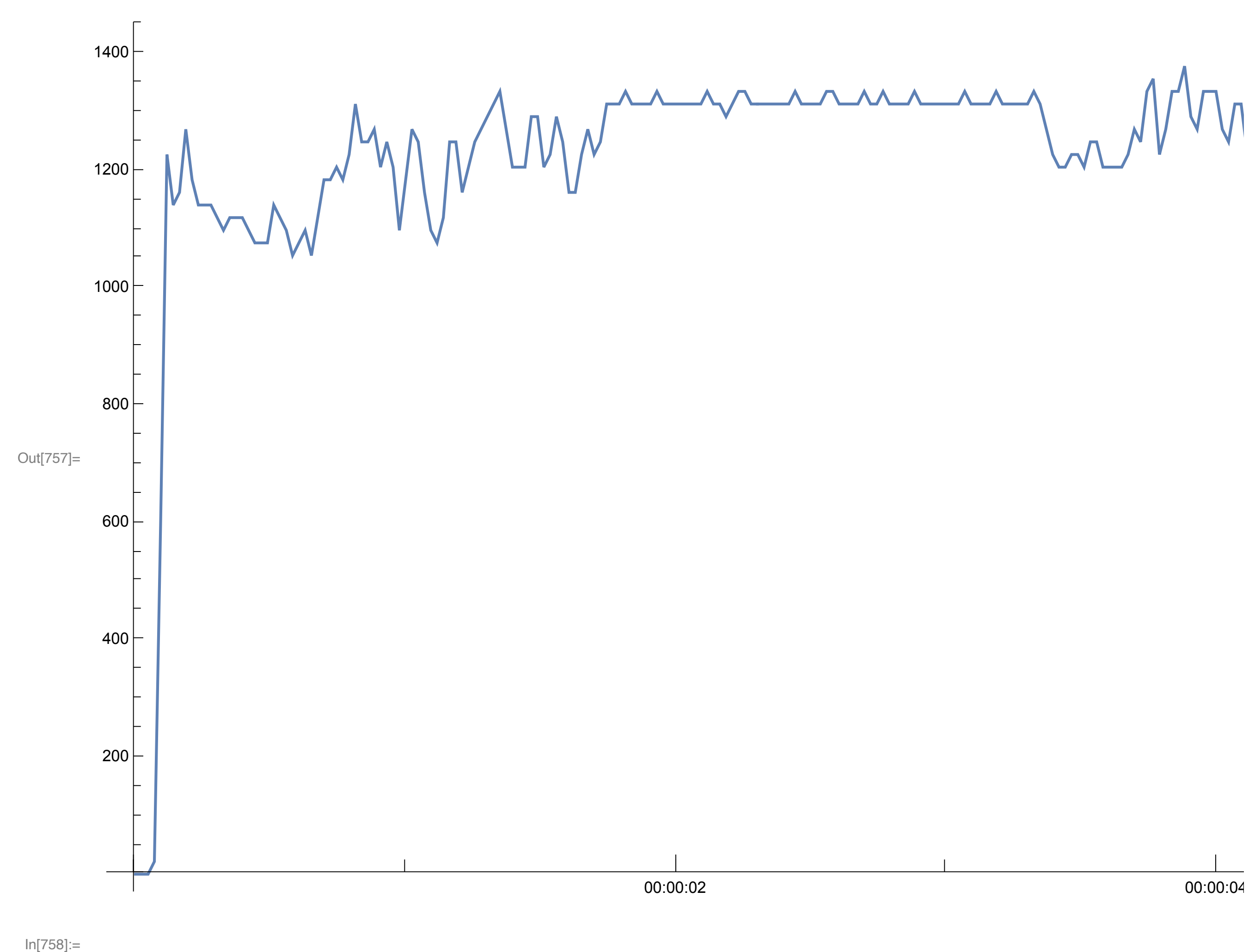
Out[755]=



Out[756]=



Out[757]=



In[758]:=

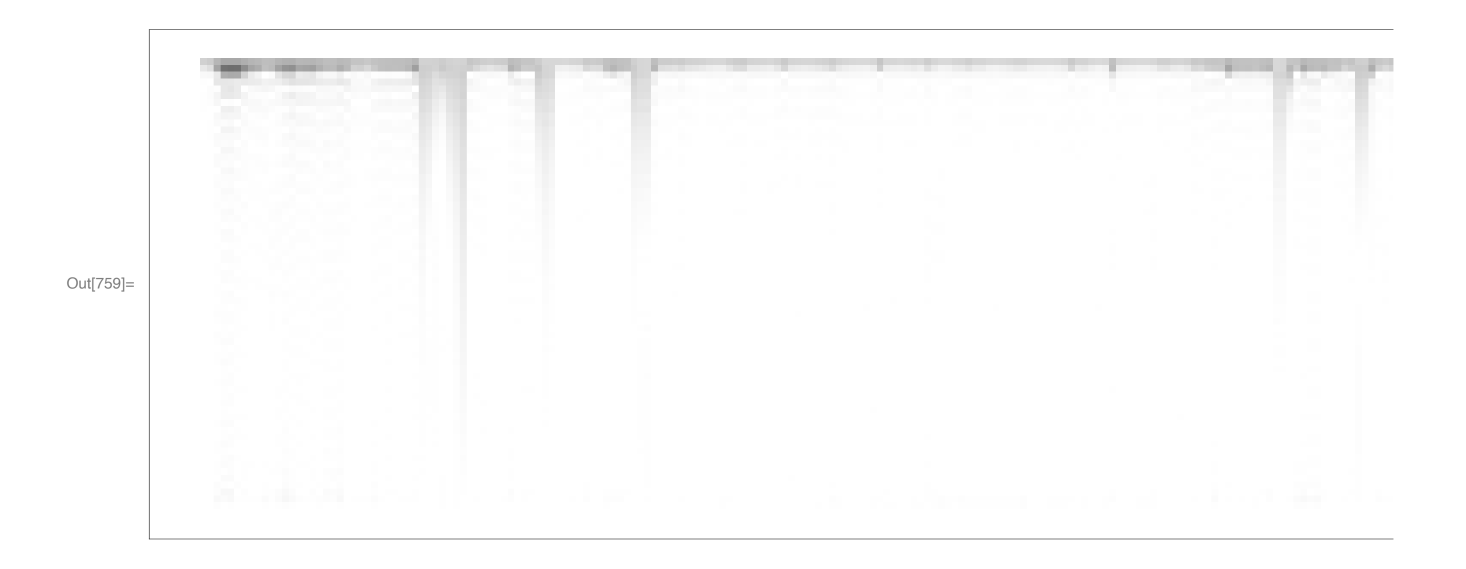
```
AudioLocalMeasurements[a, "LPC"]["Values"] // Transpose // ArrayPlot
AudioLocalMeasurements[a, {"LPC", 66}]["Values"] // Transpose // ArrayPlot

formants = AudioLocalMeasurements[a, "Formants"];
Show[Spectrogram[a, AspectRatio → 1, PlotRange → {All, {0, 7000}}],
 formants // ListLinePlot]

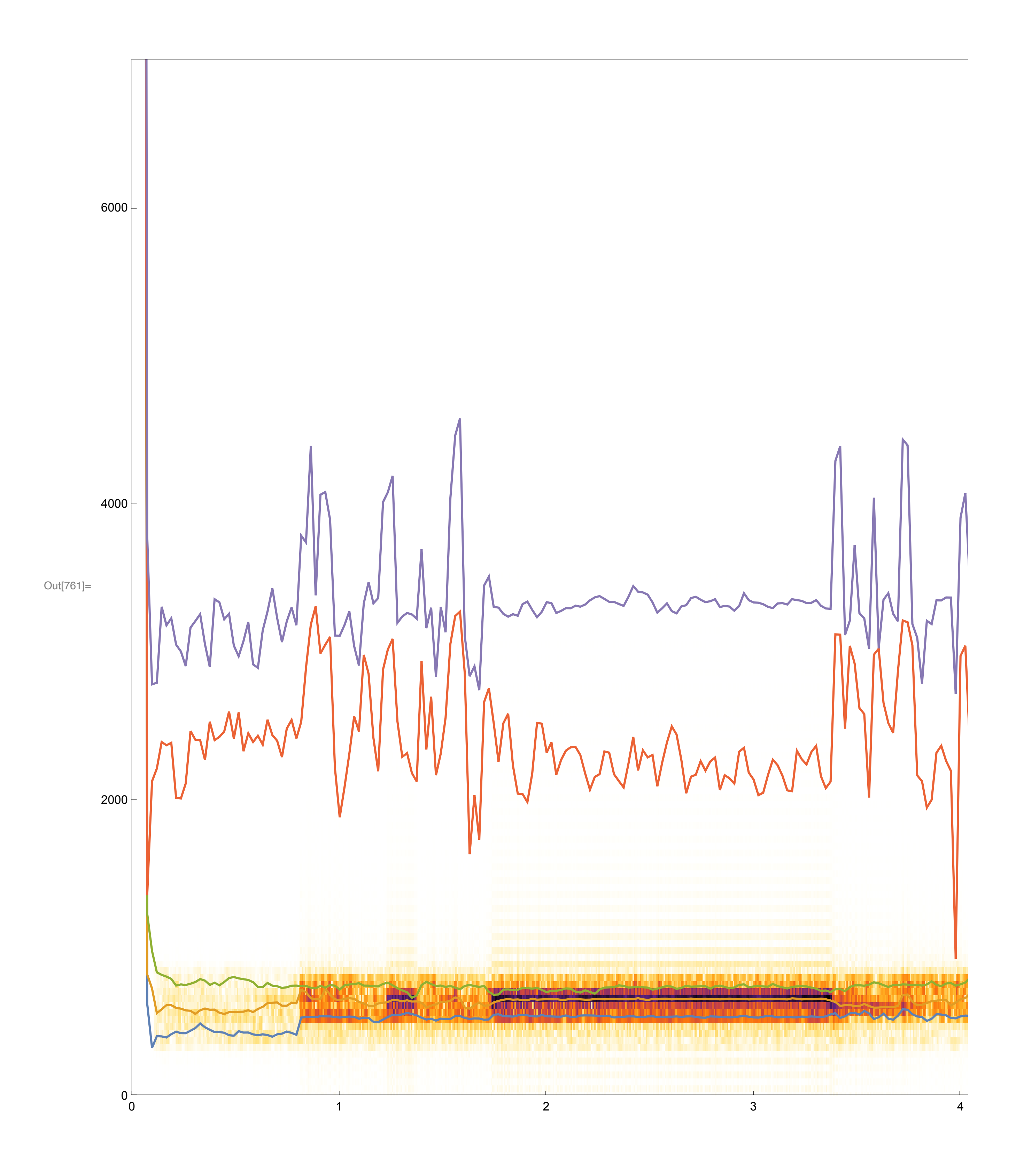
formants = AudioLocalMeasurements[a, {"Formants", 2, 40}];
Show[Spectrogram[a, AspectRatio → 1, PlotRange → {All, {0, 7000}}],
 formants // ListLinePlot]
```

Out[758]=

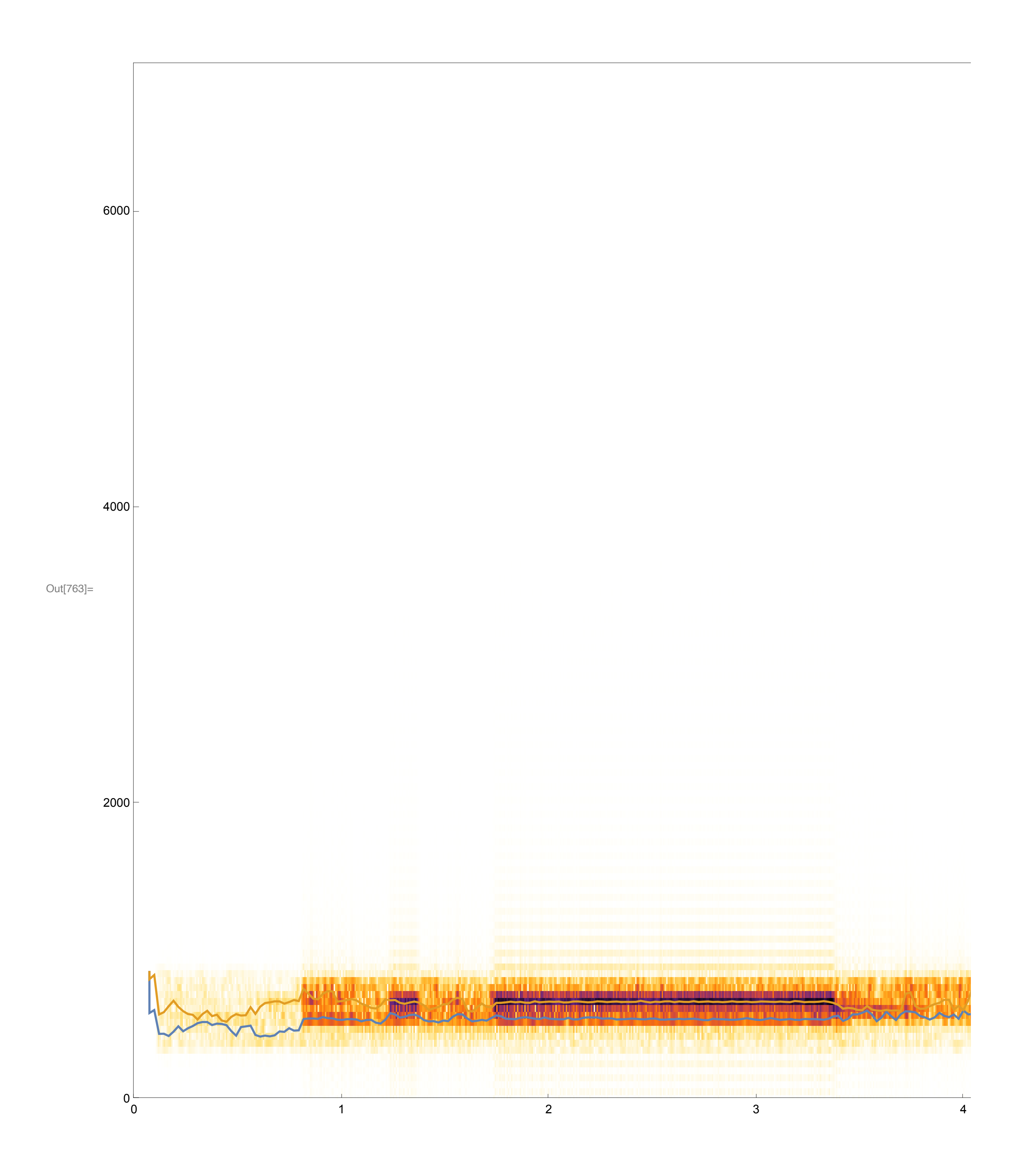
Out[759]=



Out[761]=



Out[763]=





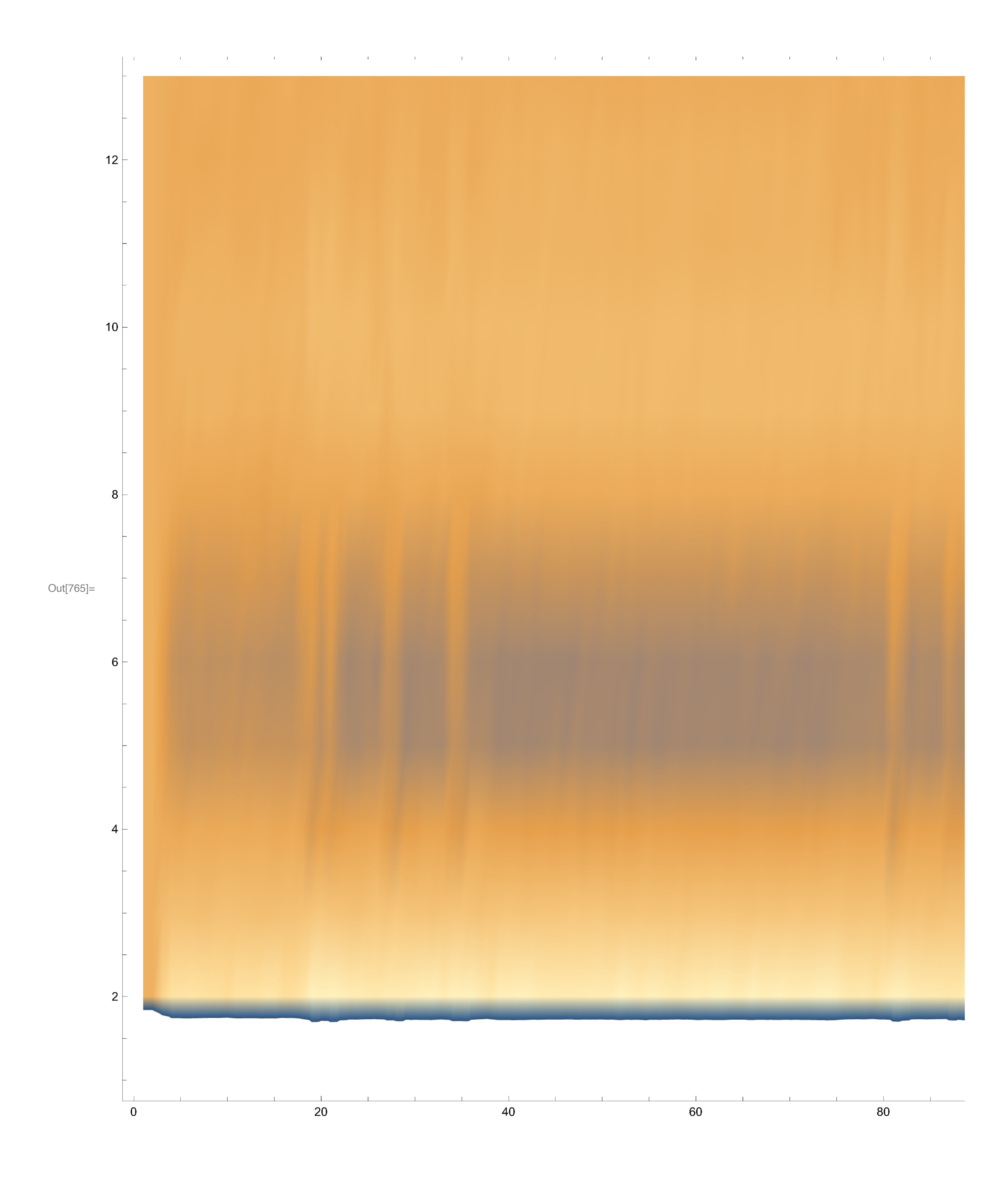
In[764]:=
```
AudioLocalMeasurements[a, "Entropy"] // ListLinePlot[#, PlotRange → All] &
```

Out[764]=

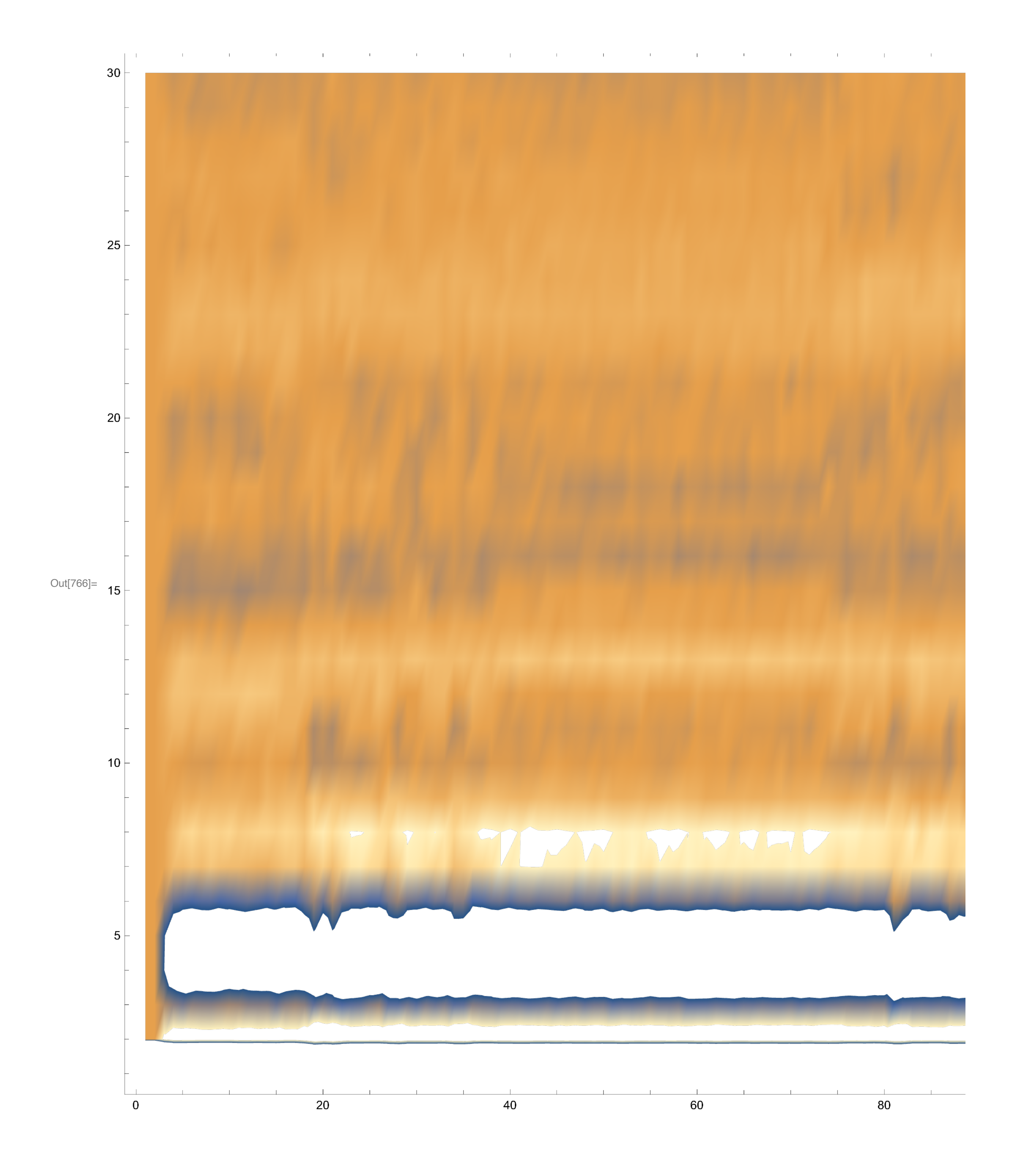
8
6
4
2
00:00:02
00:00:04

In[765]:=
```
AudioLocalMeasurements[a, "MFCC"]["Values"] // Transpose // ListDensityPlot
AudioLocalMeasurements[a, {"MFCC", 30, 40,
     Quantity[40, "Hertz"], Quantity[30 000, ("Radians") / ("Seconds")]}][
   "Values"] // Transpose // ListDensityPlot
```

Out[765]=

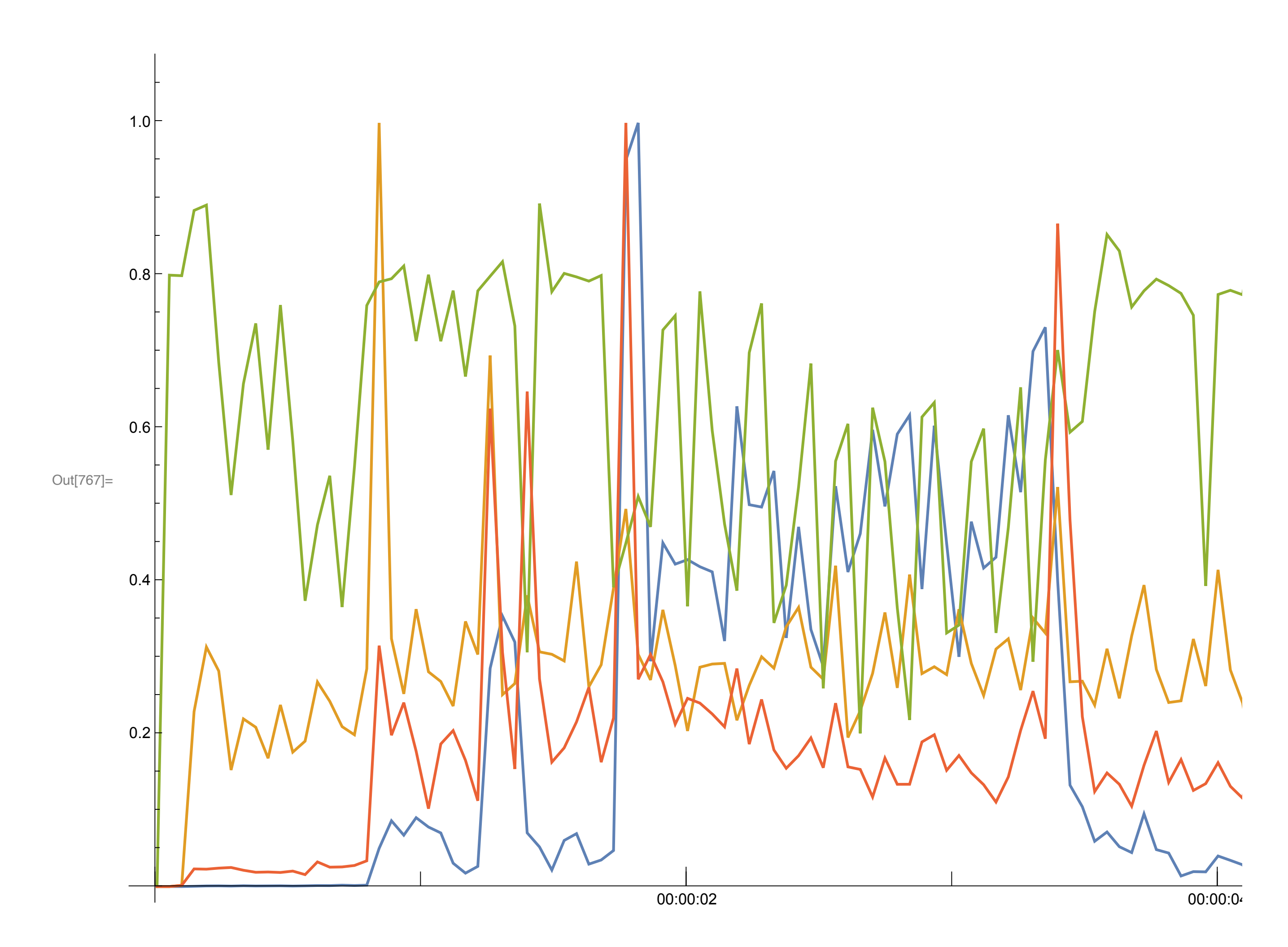


Out[766]=

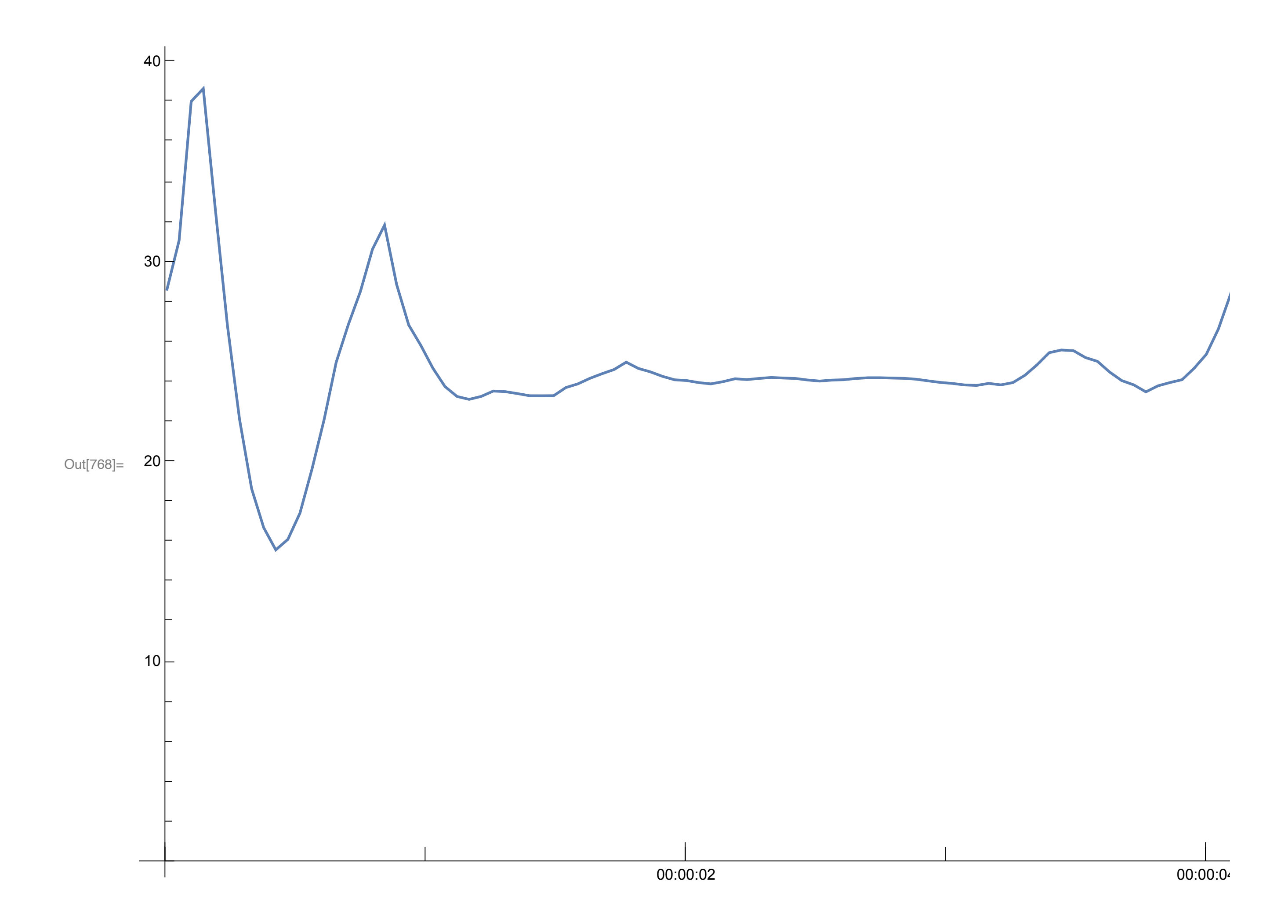


In[767]:=
```
Rescale /@ AudioLocalMeasurements[a, {"ComplexDomainDistance",
    "ModifiedKullbackLeibler", "PhaseDeviation", "SpectralFlux"}] // ListLinePlot
ListLinePlot[AudioLocalMeasurements[a, "Novelty"], PlotRange → All]
```

Out[767]=

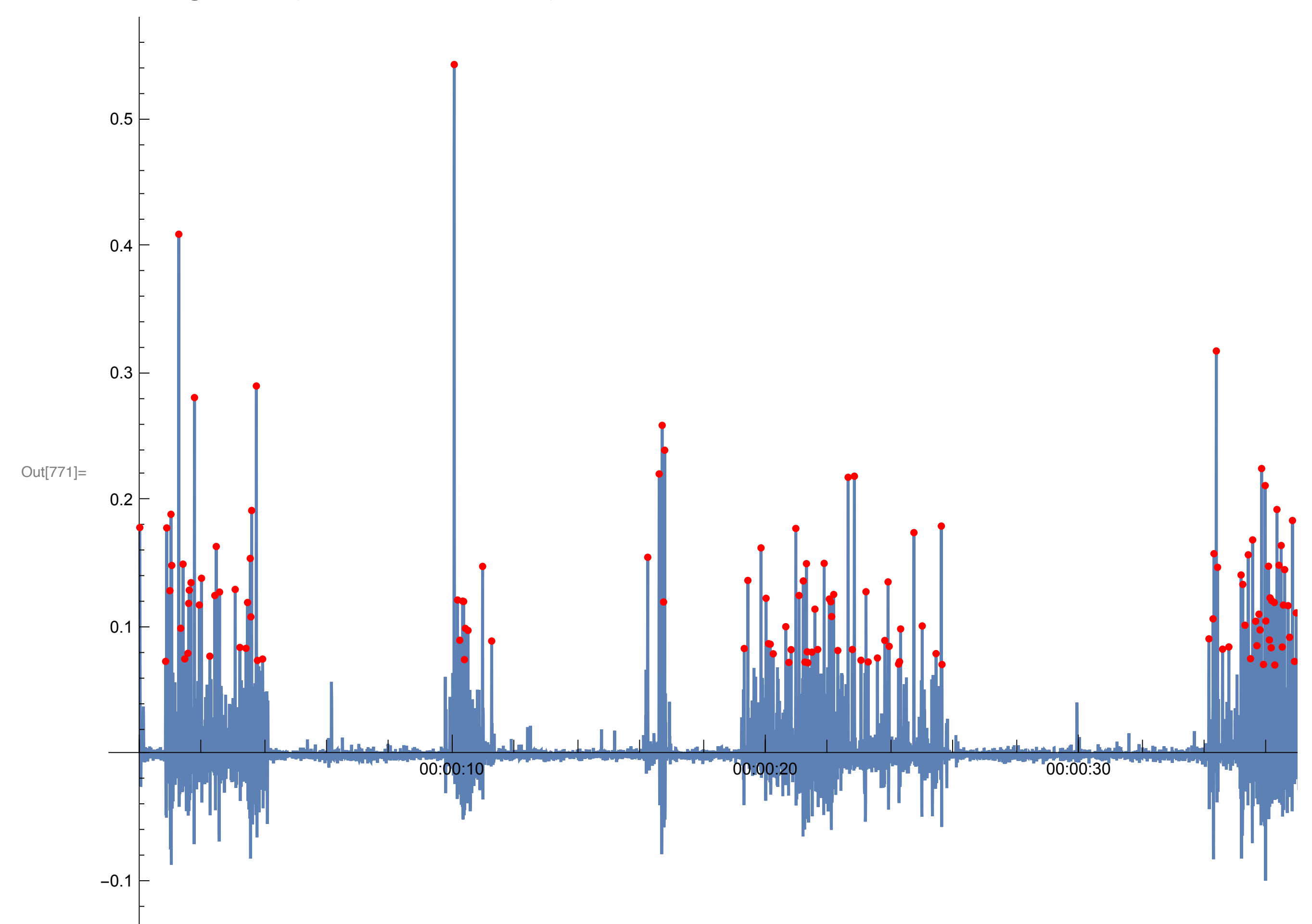


Out[768]=



In[769]:=
```
properties = {"ComplexDomainDistance", "HighFrequencyContent",
   "ModifiedKullbackLeibler", "Novelty", "PhaseDeviation"};
detectionFunctions = Rescale /@ AudioLocalMeasurements[
    a, properties, PartitionGranularity → {.02, .005}];
peaks = FindPeaks[filteredDetectionFunction, 0, 0, 0.07];
ListLinePlot[filteredDetectionFunction, PlotRange → All,
 Epilog → {Red, PointSize[0.005], Point[peaks // Normal]}]
```

Out[771]=



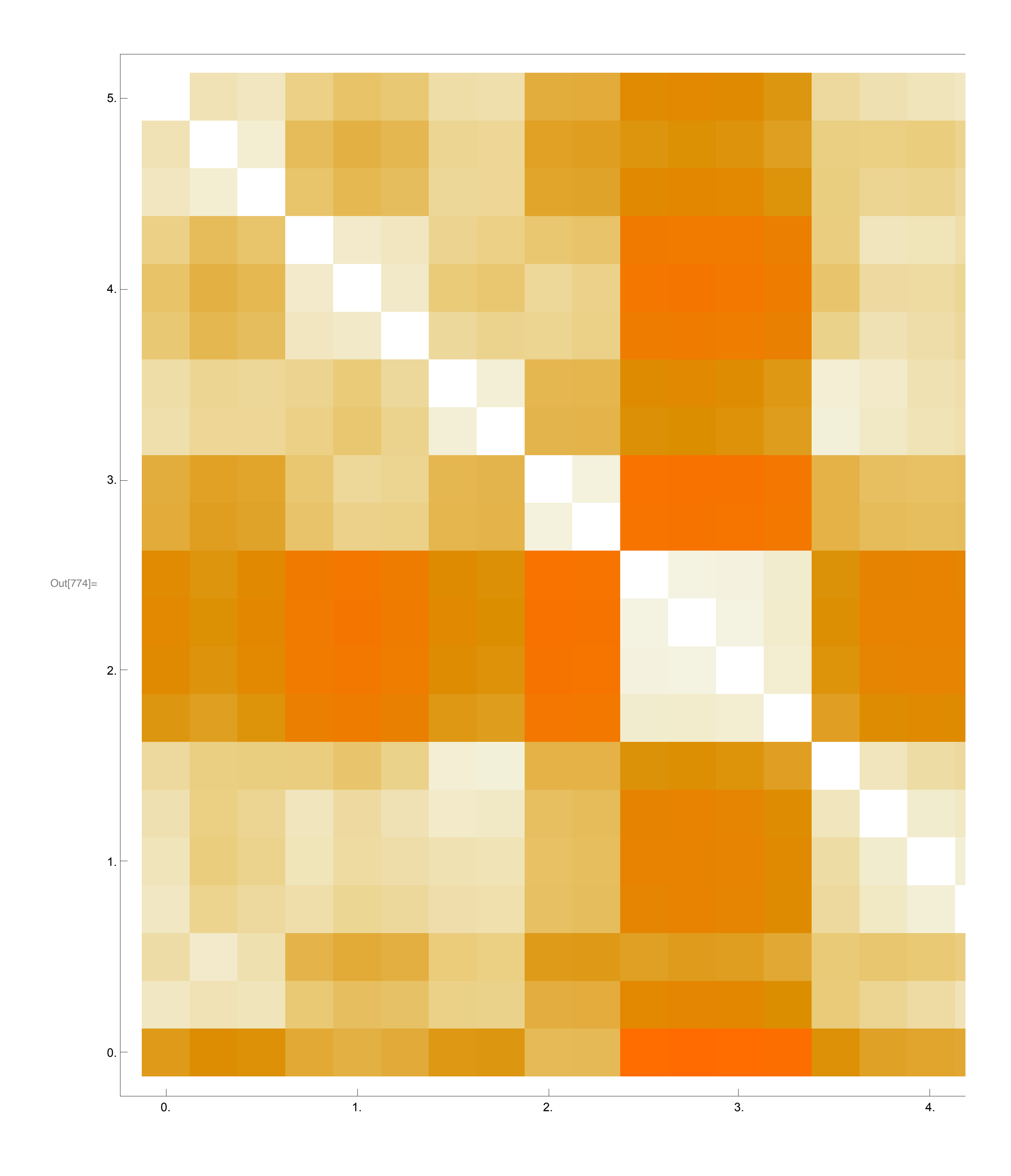
In[772]:=
```
AudioPlot[a,
 ColorFunction → Function[{x, y}, If[AnyTrue[peaks["Times"], Abs[x - #] < .015 &],
    RGBColor[1, 0.2, 0.2], RGBColor[0.368417, 0.506779, 0.709798]]],
 PlotRange → {All, All}, FillingStyle → Opacity[.9]]
```

Out[772]=

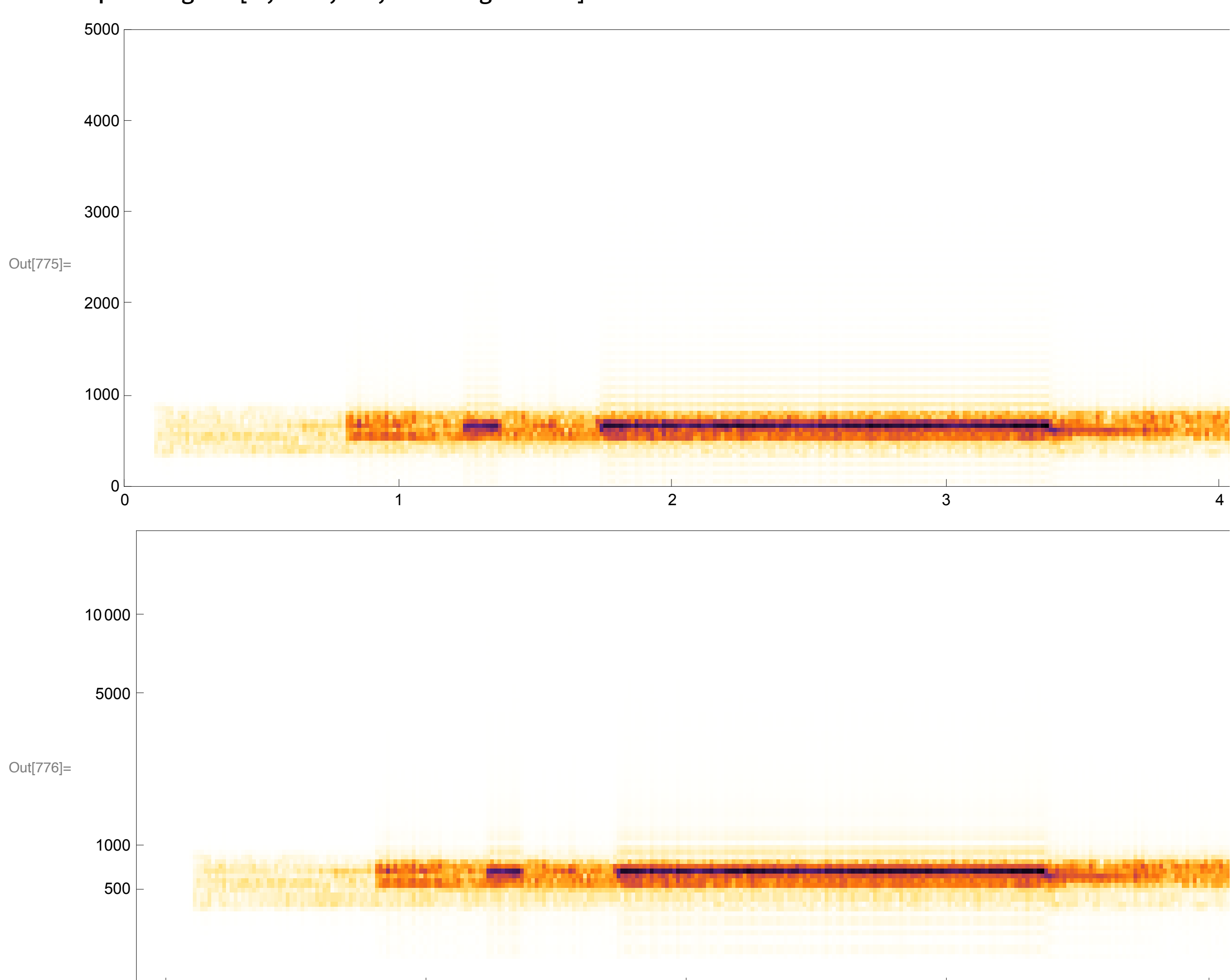
0.1
-0.1
0 1 2 3 4

In[773]:=
```
mfcc = AudioLocalMeasurements[AudioResample[a, 11 025],
    "LPC", PartitionGranularity → {.5, .25}]["Values"];
MatrixPlot[DistanceMatrix[mfcc],
 DataRange → {{0, QuantityMagnitude[Duration@a, "s"]},
   {0, QuantityMagnitude[Duration@a, "s"]}},
 ImageSize → 800, FrameTicks → {Automatic, Automatic}]
```

Out[774]=

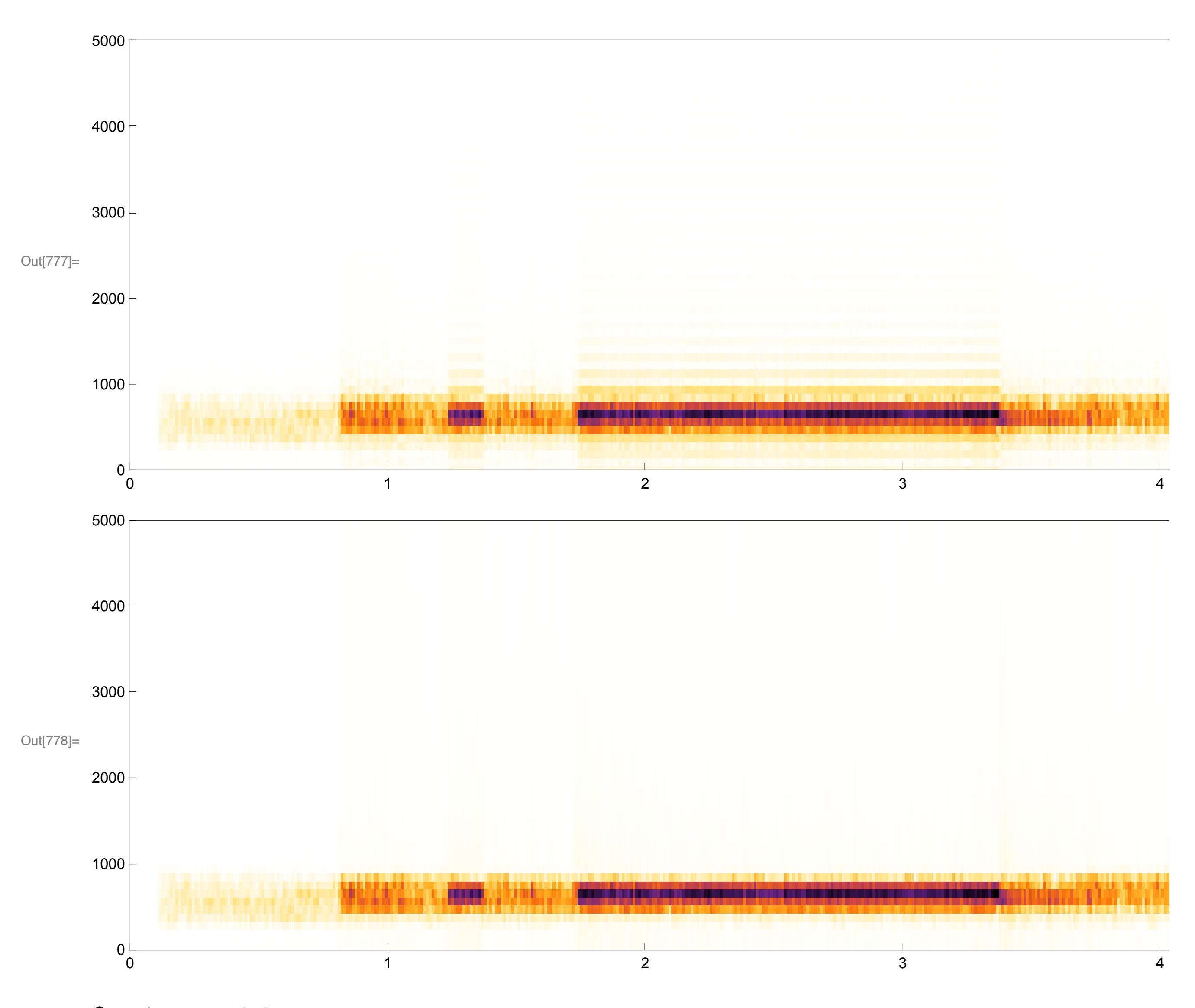


In[775]:=
```
Spectrogram[a]
Spectrogram[a, Method → "MelFrequency"]
Spectrogram[a, 512, 64]
Spectrogram[a, 512, 64, HammingWindow]
```

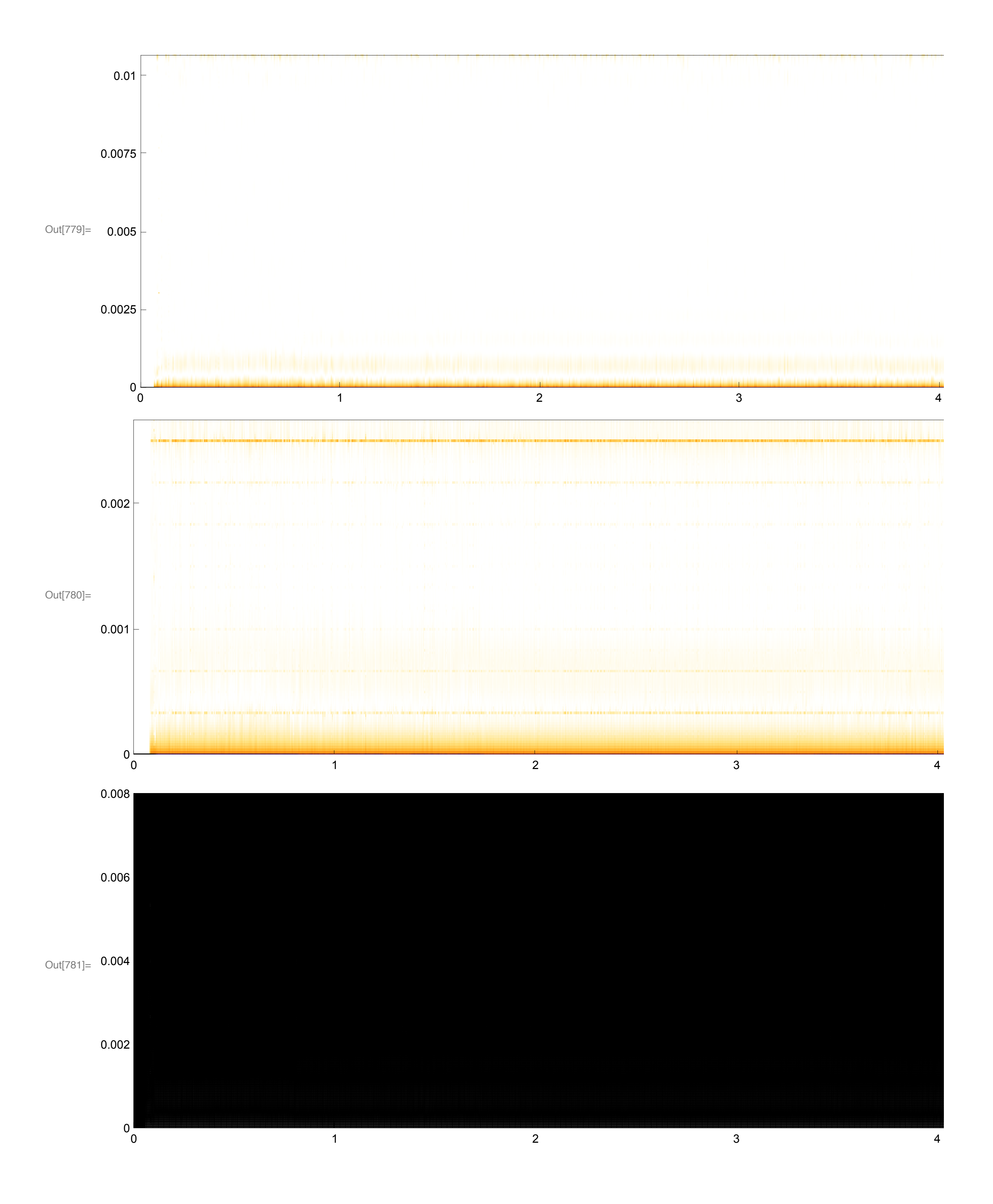


Out[777]=

Out[778]=



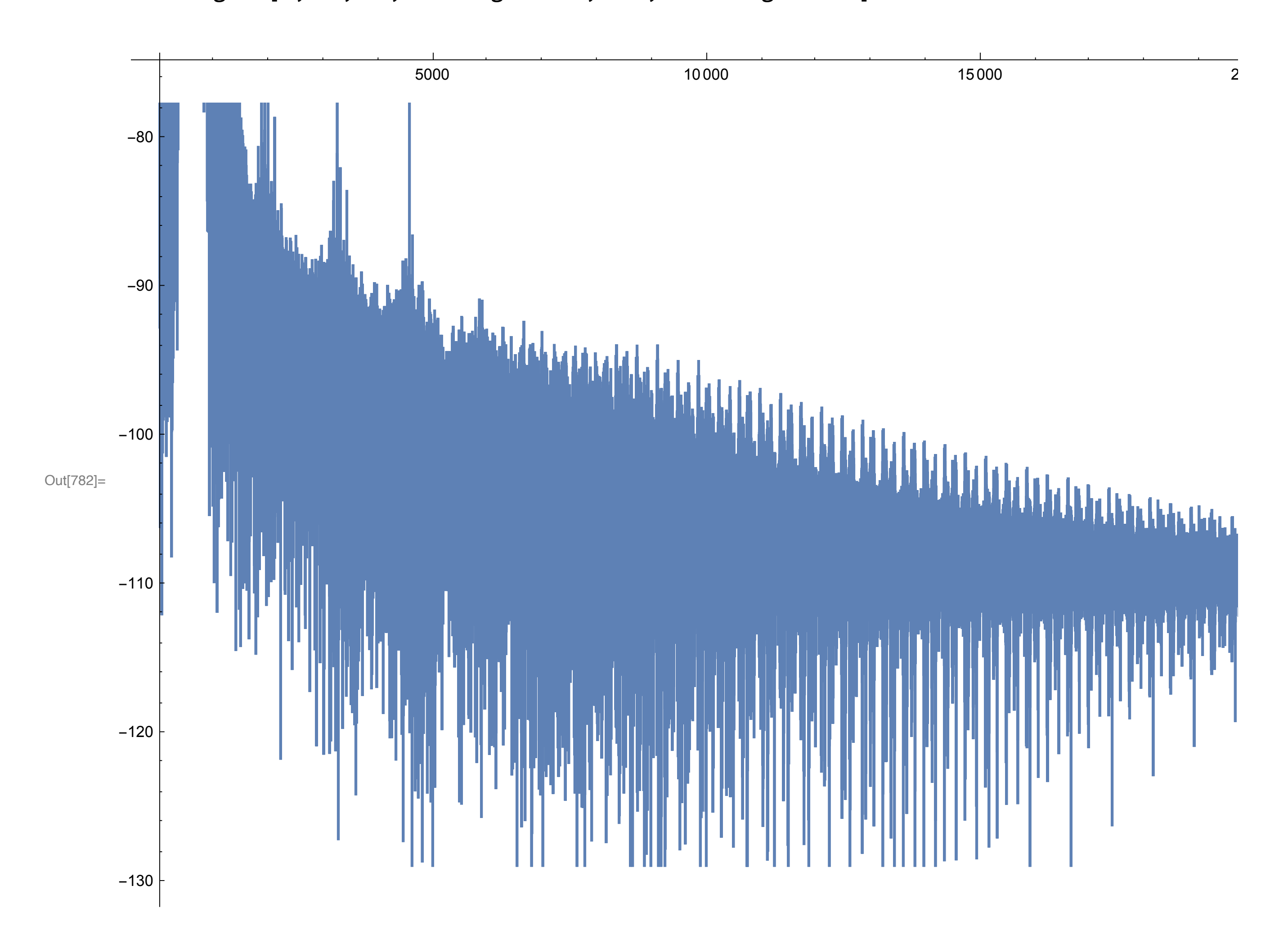
In[779]:=
```
Cepstrogram[a]
Cepstrogram[a, 256, 64, HammingWindow]
Cepstrogram[a, 2048, 64, PlotRange → {All, {0, .008}, All},
 AspectRatio → 1 / 3, ColorFunction → (Blend[{{0, Black}, {.2, White}}, #] &)]
```



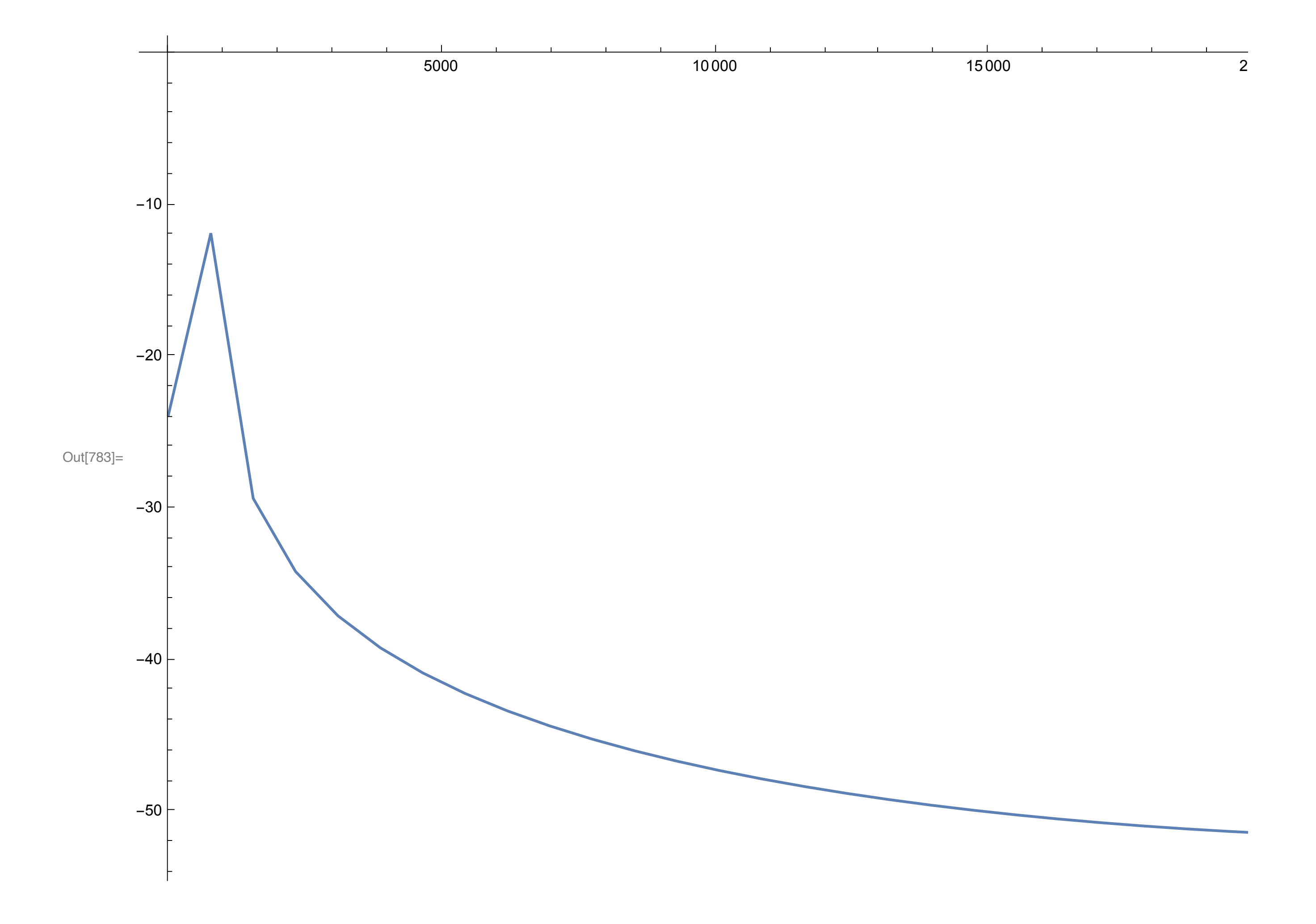
Out[779]=
0.01
0.0075
0.005
0.0025
0
0
1
2
3
4
Out[780]=
0.002
0.001
0
0
1
2
3
4
Out[781]=
0.008
0.006
0.004
0.002
0
0
1
2
3
4

In[782]:=
```
Periodogram[a]
Periodogram[a, 64, 32, PlotRange → All]
Periodogram[a, 64, 32, HammingWindow, 256, PlotRange → All]
```

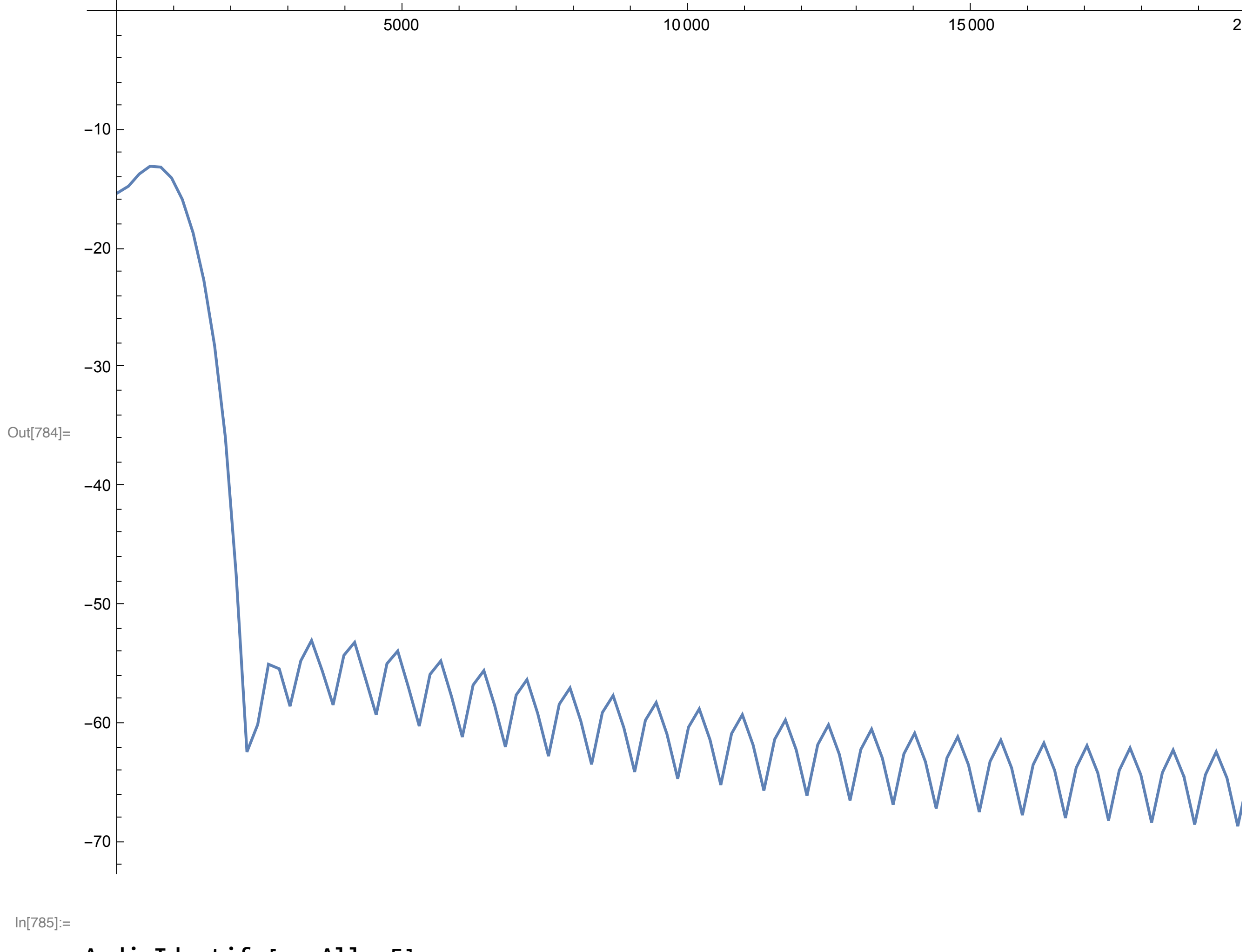
Out[782]=



Out[783]=



Out[784]=



In[785]:=

```
AudioIdentify[a, All, 5]
```

Out[785]= {radio, silence}